Appendix B
RCRA Standard Operating Procedures
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Department of Environmental Protection
Bureau of Remediation & Waste Management
RCRA Program

Standard Operating Procedure Change Record

Title: COLLECTION OF HOUSEHOLD WATER SAMPLES PROTOCOL

Identification #: DR01

SOP Originator: Brian Beneski

Author	Revision	Description of Change	Date
Deb Stahler	RCRA 01	Substitute MEDEP/RCRA in the place of MEDEP/DR, and Division of Oil and Hazardous Materials in the place of Division of Remediation. Section 2.0 Introduction: Change first sentence to "MEDEP/RCRA is responsible for the investigation and subsequent corrective actions for RCRA facilities throughout Maine." Section 5.0 Guidelines/ Procedures: Add: GRO samples must be preserved with HCl to pH<2 and chilled to 4^{o}C. DRO samples should also be presedrved with HCl or sodium bisulfate. Include the attached steps to minimize interference of plumbing grease in DRO samples.	5/31/02

Approved by:

Scott Whittier, RCRA Program Director Date:

Recommended DRO Sampling Guidelines for Minimizing Plumbing Grease Interference

For obtaining unfiltered water sample for DRO analysis:

- First, determine if there is any type of filter or softener on the system. Visually inspect in the basement and under the kitchen sink. Check with homeowners to see if they have recently used their water that day (i.e. showers, laundry etc.)
- If not, allow water to purge until you hear water pump come on at least twice (so we know that water sampled is from the well and not plumbing).
- If there is no filter, remove the aerator from the kitchen faucet and purge lines for 5 minutes (do not adjust flow between purging and sampling). Sample for DRO first. **DO NOT ADJUST WATER FLOW**. This can release mineral grease into the sample, thus causing a false positive for DRO. To sample for GRO [or other test] you may adjust water flow as necessary after obtaining the DRO sample.
- If there is a filter or softener then you must sample from the plumbing system prior to the filter or softener system. Typically this is done at the pressure tank boiler valve, using the [Alex Pugh] sampling device. Attach device to the boiler valve next to the pressure tank and attach a fresh piece (2-3 feet) of tubing to it. Turn valve on so that a steady laminar flow of water is coming out. Have one team member hold the tubing and bucket, the other sample. Allow water to flow for 5 minutes. Sample for DRO first. **DO NOT ADJUST WATER FLOW**. To sample for GRO [or other test] you may adjust water flow as necessary after obtaining the DRO sample. Remove sampling device and decontaminate before next use.

Sampling From Granular Activated Carbon Systems:

- Open all sample port valves and purge 3 to 4 gallons through each valve.
- Collect samples for DRO without any adjustments to the valve – do not increase or decrease flow
- Decrease flow for GRO and other sample parameters.

COLLECTION OF HOUSEHOLD WATER SAMPLES PROTOCOL

Maine Department of Environmental Protection

Division of Site Remediation

Standard Operating Procedure: **DR#001**
REVISION: **#5**
DATE: **December 23, 1998**
Written/Revised by: Brian Beneski
Reviewed by: Denise Fournier

1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Remediation's (MEDEP/DR) procedure for collecting water samples from household wells at or near uncontrolled hazardous substance sites.

2.0 INTRODUCTION

MEDEP/DR is responsible for the investigation and remediation of uncontrolled hazardous substance sites throughout Maine. In the course of the investigation and subsequent remediation, samples must be taken to determine the geographical extent, chemical characteristics, and relative levels of contaminants at each site and the surrounding area. This standard operating procedure (SOP) is designed to be a guideline for collecting water samples from household wells (dug, drilled, etc.) either with or without filtration devices.

Sampling household water supplies is essential to the proper investigation of groundwater contamination at a potential/ actual hazardous waste site. Each well supplying a household(s) also represents a monitoring well for local groundwater. Such information/data must be factored into the groundwater investigation program.

The three most important aspects of household water sampling are as follows: 1) develop a sample plan that adequately and appropriately meets the sampling goal (see also SOP DR#014-Development of a sampling plan); 2) follow established sampling procedures to ensure the integrity of the sample, and; 3) keep accurate records of sampling data (i.e. locations, bottle numbers, etc.).

3.0 RESPONSIBILITIES

All Uncontrolled Sites Program Staff must follow this procedure when performing activities involving the collection of water samples from household wells. All Managers and Supervisors are responsible for ensuring that their staff are familiar with and adhere to this procedure.

4.0 DEFINITIONS

-- Treatment System - A device which removes volatile compounds from water by volatilizing the contaminants out of the water (such as an air stripper), or a

device packed with granular activated carbon which removes contaminants by adhesion from the water as the water passes over and through the granular activated carbon.

-- Sample Point - Any location from which a representative water sample may be obtained.

5.0 GUIDELINES/PROCEDURES

5.1 Preparation

Sampling plan development guidance can be found in SOP DR#014 – Sampling Plan Development. However, residential sampling does require several unique aspects, the most important being scheduling. All residents should be informed at least one week ahead of the scheduled sampling event, particularly if access to filters or air strippers is required. Be aware of the past contamination history of the site and try to plan visits so that sampling begins with the least contaminated households and ends with the most contaminated households. This method allows the least potential for cross-contamination, and should be followed whenever practical. Allow at least twenty (20) minutes between each sampling appointment. Also, if this is an initial visit to a household, bring a well data sheet (Attachment X) and get as much information about each household's well(s) as possible. Important information/data to gather when sampling household wells includes: date of installation of the well; the type of well (drilled, dug, point, or other); gallons per minute produced; depth to the screened interval (and width of screened interval if applicable), and type of piping used.

5.2 Equipment

Below is a list of recommended equipment to have when household sampling:

-- Bucket(to collect excess water when sampling filters)
-- Gloves(to prevent exposure and/or cross-contamination)
-- Flashlight(to enter dark basements/cellars)
-- Field Notebook(to record pertinent information)
-- Chain of Custody Forms(to document chain-of-custody)
-- Label Tags(to label sample ports at households with filters)
-- Container with Deionized Water(for rinsing)
-- Container with Soapy Water(for washing)
-- Sampling Containers from laboratory

5.3 Health and Safety

Part of completing a successful household sampling assignment is completing it in a safe and healthful manner. Whenever sampling water from any point, at a minimum wear latex gloves. Latex gloves decrease the chance of dermal exposure and also reduce the chance of cross-contamination of samples. In cases where the raw water(unfiltered) is suspected or known to be contaminated, wear a chemical-resistant outer glove(i.e. nitrile, PVC, neoprene) that is resistant to the contaminants suspected or present.

Also be aware of physical hazards; filters are usually located in the basement, so make sure to take a flashlight. Watch for overhead hazards such as low ceilings and/or hanging objects. Be especially careful of electrical hazards such as outlets near the sampling area and/or bare wires. Lastly, try not to splash the water when sampling; splashing contaminated water in the eyes or on exposed skin could be harmful if the water is significantly contaminated. If water supplies are known or suspected to be grossly contaminated, the sampler should wear chemical resistant goggles/glasses. As a conservative approach, assume all water being sampled is contaminated until proven otherwise.

5.4 Sampling

5.4.1 Sampling Households Without Treatment System

When sampling at a household with no filters on the water system, take the sample from an indoor faucet (kitchen, bathroom, other) or an outside spigot, preferably from the closest spigot to the well in the plumbing system. Make sure that the sample point is clean (i.e., no grease, lead soldering, or other possible contaminants) and that no possible sources of cross-contamination (gas cans, solvents, etc.) are nearby. If other water treatment systems such as radon or sediment filters or water softeners have been put on the water system, the sample should be collected prior to these systems. If sampling from a kitchen faucet, remove the aerator; if sampling from an outside spigot, remove any hoses or attachments to the spigot. Run the water on cold at full flow for least ten(10) minutes.

Running the water will accomplish two goals. First, it will purge the pipes of any stagnant water; second, it will drain the pressure tank and cause the pump to turn on and start pumping the well. This should assure the collection of a fresh and representative sample from the well.

the laboratory. If sampling from a sink faucet, be sure to remove any aerators on faucet.

The between filter sample should be taken next. Run this sample port water ten to twenty seconds prior to sampling to remove any residue/contaminants from the port. Use a bucket to catch the excess water produced when running the water and taking the sample. Once again, gloves must be worn to prevent cross-contamination of the samples.

The sample before the filter system is taken last due to its highest probability of being contaminated. Run the sample port water ten to twenty seconds to remove the residue/contaminants from the port. The bucket will again be necessary to catch excess water from this sampling port. Gloves will be necessary not only to prevent cross-contamination of samples, but also to protect the sampler from dermal exposure.

If multiple treatment systems exist, it may be necessary to take more samples. Many air-strippers have ports (spigots) both before and after the stripper expressly for the purpose of taking samples. Filtration devices can often be bypassed with bypass valves included in the plumbing. When sampling any of these devices, trace the route of the plumbing (pipes) to make sure the sample is being taken from the correct sampling port. Be sure to include contingencies for such devices in the sampling plan.

Once all the samples have been collected from a residence, remove gloves, and return all plumbing to its original position (aerator back on faucet, all sample ports closed). Record water meter readings if the residence is equipped with a meter. Be sure to note if the meter reading is in cubic feet or gallons. The water meter reading will give (in conjunction with the previous reading) the amount of water being used by the household, which is useful in predicting/explaining the breakthrough in GAC filters. Add any necessary preservatives to the samples and place the samples in a cooler on ice for transport to the laboratory. Wash your hands before proceeding to the next household to be sampled. Again, a new pair of gloves should be worn at every residence.

6.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

In order to insure that the samples are representative of the water at a given sampling point, the sampler must pay close attention to QA/QC procedures. At each household the sampler must be aware of four (4) areas which may be sources of cross-contamination of the samples: 1)gloves--wear a new pair at

every residence sampled; 2)sampling point--sample at the least contaminated households first, the most contaminated last; 3)self-contamination--make sure the sampling area is free of any possible sources of contamination(grease on the tap, solvent bottles near the sample port), and; 4)piping--look at the plumbing and pipe materials and note the presence of lead soldering or improper lubrication (i.e. WD-40, oil, etc.) on the pipes. Also, ask the resident if any work had recently been done on the well, plumbing, or any other components of the water system.

Perhaps the most important QA/QC procedure that must be part of every sampling event is the inclusion of a trip blank in the cooler. This trip blank should be collected from the laboratory doing the analysis, preserved with the same preservative as the actual samples, stored and transported with the other samples collected during the sampling event, and then analyzed (along with the other samples) for the appropriate suspected contaminants by the lab. If a sampling event is completed and the trip blank contains contaminants, this indicates that the containers may not have been clean or other QA/QC procedures have failed. In this case, it may be necessary to re-sample. Consult with the project manager and laboratory personnel before re-sampling a site.

Sampling personnel must use common sense prior to and during sampling activities in order to avoid problems. For instance, samplers should try to avoid gassing up a vehicle on the day of the sampling event. Avoid the use of colognes, perfumes and bug sprays on sampling days. Wash hands thoroughly prior to any sampling activities. In addition, sampling personnel should avoid any contact with inside surfaces of sample containers and covers or caps.

In the event that problems occur, such as contamination between filters (and not before or after), check all possible sources of error before arranging to re-sample the household. Recheck all field documentation from the trip to insure the sample numbers were recorded correctly in both the field notebook and on the laboratory analysis request sheet and/or chain of custody. Talk with the person(s) completing the analysis in the laboratory and ask about possible sources of error. If the documentation check fails, go back to the site and re-sample. When re-sampling, be sure to check the plumbing to make sure all valves are properly opened and closed. An open bypass valve would bypass the filters and supply unfiltered raw water to the house.

In some instances, a household may have contamination before the filter and between the filter. In this case, the between filter spigot should be re - sampled and analyzed as soon as possible in order to confirm the breakthrough of the first GAC

filter, or the first filter should be changed or repacked as soon as possible. If the determination has been made that the first filter has contaminant breakthrough, then arrangements should be made to have the filter replaced and/or repacked with carbon. Whether to resample or change filters is a decision to be made following consultation with the project manager.

7.0 DOCUMENTATION

Sampling at a household is only as good as the records kept of the sampling event. Records should be kept in a field notebook in the manner described in the SOP DR#013, as well as a Site Event Trip Report, also described in SOP DR#013.

8.0. REFERENCES

U.S. Environmental Protection Agency, "A Compendium of Superfund Field Operations Methods," EPA-540/P-87/001, December 1987.

U.S. Environmental Protection Agency, "Sampling of Hazardous Materials," EPA, April 1990.

Well Data Sheet

Name:_____ Town:_____

Address:_____

Mailing Address:_____

Daytime Phone Number:_____ Evening PhoneNumber:_____

Permission to survey well location with GPS? Yes No Comment:_____

Map Number:_____ Lot Number:_____

Circle those that apply

Public Water Drilled Bedrock Well Drilled Overburden Well
Dug Overburden Well Unknown_____

Date well was installed:_____ Installer:_____

Depth of Well:_____ Length of Casing:_____

Casing type:_____ Casing Diameter:_____Approximate Yield:_____

Any problems with well? _____
_____
_____

Any odors or taste problems? _____
_____
_____

Water Treatment? Yes No Type_____

Physical Location of Well:_____

Buried well head? Yes _____ No_____

Additional Comments_____
_____
_____

Draw Site Sketch on back

Sample Numbers:
DRO:_____
GRO:_____
VOC:_____
SVOC:_____
Inorganics:_____

Samplers/Investigators:_____

Department of Environmental Protection
Bureau of Remediation & Waste Management
RCRA Program

Standard Operating Procedure Change Record

Title: **GROUNDWATER SAMPLING FROM MONITORINGWELLS USING A BAILER PROTOCOL**

Identification #: DR02

SOP Originator: Brian Beneski

Author	Revision	Description of Change	Date
Deb Stahler	RCRA 01	Substitute MEDEP/RCRA in the place of MEDEP/DR, and Division of Oil and Hazardous Materials in the place of Division of Remediation. Section 2.0 Introduction: Change first sentence to "MEDEP/RCRA is responsible for the investigation and subsequent corrective actions for RCRA facilities throughout Maine." Section 6.5 Sample Collection: Change the first sentence of paragraph 2 to "Preserve all samples according to guidelines in SAMPLING CRITERIA FOR METALS AND ORGANIC COMPOUNDS.	5/31/02

Approved by:

Scott Whittier, RCRA Program Director Date:

GROUNDWATER SAMPLING FROM MONITORING WELLS USING A BAILER PROTOCOL

Maine Department of Environmental Protection

Division of Site Remediation

Standard Operating Procedure: **DR#002**
REVISION: **#6**
DATE: **January 21, 1999**
Written/Revised by: Brian Beneski
Reviewed by: Gordon Fuller

1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Remediation (MEDEP/DR) procedure for collecting groundwater samples from monitoring wells at or near hazardous substance sites utilizing bailers.

2.0 INTRODUCTION

MEDEP/DR is responsible for the investigation and subsequent remediation of uncontrolled hazardous substance sites throughout Maine. In the course of the investigation and subsequent remediation, samples must be collected and analyzed to determine the geographical extent, chemical characteristics, and relative levels of contaminants at and around each site. For this reason groundwater monitoring wells are often installed onsite and around a site. Low Flow Purging and Sampling (LFS) is the preferred method for obtaining groundwater samples from monitoring wells (see SOP DR#003 - Low Flow Purging and Sampling Protocol). However, LFS is not always a viable sampling method at all monitoring wells. For those wells that are not conducive to LFS, this procedure will be followed. The reason for using bailers instead of LFS should be outlined in the sampling and analysis plan (SAP) or Sampling Event Trip Report (SETR) developed for the specific activity

3.0 RESPONSIBILITIES

All MEDEP Staff must follow this procedure when performing activities involving the collection of groundwater samples from monitoring wells with bailers. All Managers and Supervisors are responsible for ensuring that their staff are familiar with and adhere to this procedure.

4.0 DEFINITIONS

-- Bailer - A long narrow cylinder or bucket-like device with an open top and a check valve at the bottom that is used to remove water from a monitoring well.
-- Equipment Blank - Deionized water run through a piece of sampling equipment to determine if equipment may be a source of contamination.
-- Purging - The process of evacuating standing water from the monitoring well prior to sample collection.
-- Trip Blank - Deionized water put in the appropriate containers under laboratory conditions which is transported

with the samples during a monitoring event for quality assurance/quality control purposes.
-- Well Riser Pipe - A length of solid pipe which extends from the screened interval of a monitoring well to the surface of the level from which the well is accessed.

5.0 EQUIPMENT

Necessary Equipment for sampling monitoring wells with bailers include:
-- Sampling and Analysis Plan
-- Keys
-- bolt cutters & extra locks
-- Personnel Protective Equipment (as stated in SOP).
-- Sample Containers
-- Water Level Indicator
-- Temperature, Conductivity, and pH Meters
-- Bucket/pail
-- Knife
-- Plastic (bags and roll)
-- Decon supplies

6.0 GUIDELINES/PROCEDURES

6.1 Planning

Prior to conducting the sampling, a SAP should be developed which outlines the sampling activities. See SOP DR#014 - Development of a Sampling and Analysis Plan.

6.2 Initial Approach to Well

Upon approaching the well, make note of any irregularities (i.e., broken or damaged cap, unsecured lock, cracked seal, etc.), and verify the well number. Observe the soil surrounding the well, look for stains and disturbed areas. Take a picture to document problems or irregularities, and properly document the photo or slide number in your field book.

Unlock and open the well riser cap taking appropriate safety precautions and use correct personal protective equipment (PPE), as outlined in the SAP.

6.3 Calculating Well Volumes

Prior to purging and collecting a sample from the well, the stagnant water in the pipe must be evacuated in order to assure that fresh groundwater in the well is being sampled. To ensure that all stagnant water is removed from the well,

EPA protocol recommends that three to five well volumes be evacuated from the well prior to sample collection.

To calculate the water volume in a given well pipe, begin by using the water level indicator to measure depth to water. Then use a clean weighted tape measure to determine the overall depth of the well if it is not known. Whenever possible, measure from the top of the well riser pipe and not from the top of the steel outer casing. Then calculate the height of the water column by subtracting the height of water in the well from the total depth of the well, in feet.

Use the formula and chart below to calculate well volume in gallons. Again, at least three volumes should be purged from the well. When this is not possible, as in the case of purging a slow recharge well dry, it is acceptable DEP protocol to sample the well as soon as enough water (assumed to be fresh groundwater) has entered the well to obtain a sample. In circumstances when it is simply not practical to evacuate three well volumes (deep, wide diameter wells) it is acceptable protocol to evacuate one well volume and then collect field measurements for pH, temperature, and conductivity. If three consecutive sets of field measurement readings taken from purge water have stabilized to +/-10%, this is a good indication that fresh groundwater has entered the well. The water in the well can now be assumed to be fresh groundwater and a sample can be collected.

WELL DIAMETER	x GAL/FT	x HGT OF H20 IN FT	= VOLUME IN GALS
2 inch	0.1632		=
4 inch	0.6528		=
6 inch	1.469		=

6.4 Purging

In preparation for purging and sampling, an area around the well should be covered with a clean polyethylene sheet. This will keep all instruments and equipment from contacting the ground and any contamination which could be present on the ground surface. Previously cleaned or new purging/sampling equipment should be rinsed with deionized water (DI) before use.

Whenever possible (practical and economically feasible), bailers should be dedicated to specific wells. These bailers should be left hanging in the well--above the static water level in the well pipe. The SAP must include provisions for such decontamination if non dedicated equipment is used.

To purge the well, attach clean line to the bailer and lower it into the well until it touches the bottom. Then secure the end of the line or cord to an anchor on the well casing that

will hold the bailer/pump in the event that it be accidentally dropped down the well. Raise the bailer up the well while keeping the line off the ground (i.e., on the plastic sheeting). Empty the bailer water into a graduated bucket and repeat this procedure until the desired purge volume has been extracted.

Field measurements taken during the purging process include pH, conductivity, and temperature. MEDEP/DR has several meters for these measurements; operate the meters according to manufacturer's instructions kept with the MEDEP/DR field staff or with the MEDEP/Technical Services Geologist Technician. These measurements should be taken several times during the purge, and should stabilize at the time the purge has ended.

Purge water disposal is determined on a site by site basis; dispose of purge water as indicated in the SAP.

6.5 Sample Collection

The time between purging and sampling is determined by professional judgment. However, if the analysis is for volatile materials, it is recommended that sampling be performed as soon as possible after the purge is completed. If a well is purged dry or sediment and silt are present, a longer lag time prior to collecting a sample may be required.

Samples should be collected, containerized, and preserved following the analytical laboratories directions for the specific parameter. However, when sampling for volatiles, steps should be taken to minimize volatilization of contaminants to the extent possible.

6.6 Completion

Upon completion of the sample collection event from a given monitoring well, the well cap shall be secured, the area picked up, and sampling personnel and equipment must be appropriately decontaminated as necessary prior to leaving the area.

7.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Attention to QA/QC details is vital to sampling activities conducted by SIR Division personnel. QA/QC samples for the specific site work, such as trip blanks and equipment blanks, shall be collected as stated in the SAP. Appropriate chain of custody protocol (as outlined in SOP DR#012 - Chain of custody protocol), will be followed.

Using good judgment and common sense will help sampling personnel avoid many potential contamination problems during sampling activities. For instance, samplers should try to avoid gassing up a vehicle on the day of a sampling event. Ordinarily a vehicle could be gassed up the day before. Avoid the use of bug repellants and colognes and other perfumes on sampling days. At a minimum, samplers should wash hands thoroughly prior to conducting any sampling activities and should wear appropriate gloves during all purging and sampling activities. In addition, sampling personnel should avoid contact with inside surfaces of sample containers and covers/caps.

8.0 TROUBLESHOOTING

8.1 Losing Equipment Down Wells

When purging/sampling monitoring wells, samplers must take precautions to not lose a bailer or something else down a well. In the event of losing a bailer down a well (for instance when the string breaks or a knot becomes untied), it is helpful to be prepared for such a problem. It is recommended that samplers carry with them fish hooks, sinkers, etc., for this purpose A multiple hook (fish hook/lure) lowered down the well with the assistance of a weight works best for retrieving bailers. Simply lower the hook to the bailer depth and jig until the bailer is hooked. Then pull up, slow and steady.

8.2 Missing Key or Frozen Lock

Another problem incurred occasionally at a monitoring well location, is a missing key or a frozen (rusted) lock. For those times when the key is missing or does not work, it is a good idea to be prepared. Carry bolt cutters and bring spare keyed - alike padlocks just in case. Also, with regard to frozen/rusted padlocks, it is better to cut and replace the locks rather than lubricate the locks because this could possibly introduce contaminants such as petroleum distillates to the well area, and could also contaminate the hands of samplers leading in turn to cross contamination of samples. Again, sampling personnel must take all precautions not to contaminate samples.

9.0 DECONTAMINATION

Staff will follow decontamination procedures as outlined in SOP DR#017 - Decontamination Protocol. As routine practice, field personnel shall utilize as much disposable PPE and sampling equipment or supplies as possible.

10.0 DOCUMENTATION

All site visits, including sampling events with bailers, shall be documented as described in the SOP DR#013 - Documentation of Field Notebooks and development of an SETR.

11.0 REFERENCES

U.S. Environmental Protection Agency, "Sampling of Hazardous Materials," EPA, April 1990.

Department of Environmental Protection
Bureau of Remediation & Waste Management
RCRA Program

Standard Operating Procedure Change Record

Title: **GROUNDWATER SAMPLING USING LOW FLOW PURGING AND SAMPLING PROTOCOL**

Identification #: DR03

SOP Originator: Brian Beneski

Author	Revision	Description of Change	Date
Deb Stahler	RCRA 01	Substitute MEDEP/RCRA in the place of MEDEP/DR, and Division of Oil and Hazardous Materials in the place of Division of Remediation. Section 2.0 Introduction: Change first sentence to "MEDEP/RCRA is responsible for the investigation and subsequent corrective actions for RCRA facilities throughout Maine." Section 6.2 Field Procedure: Change the last sentence of paragraph 6 to "Preserve all samples according to guidelines in SAMPLING CRITERIA FOR METALS AND ORGANIC COMPOUNDS.	5/31/02

Approved by:

Scott Whittier, RCRA Program Director Date:

GROUNDWATER SAMPLING USING LOW FLOW PURGING AND SAMPLING PROTOCOL

Maine Department of Environmental Protection

Division of Site Remediation

Standard Operating Procedure: **DR#003**
REVISION: **#2**
DATE: **August 14, 2001**
Written/Revised by: Brian Beneski
Reviewed by: Troy Smith

1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Site Remediation's (MEDEP/DR) procedure for collecting groundwater samples from wells utilizing the "Low Flow" purging and sampling procedure.

2.0 INTRODUCTION

MEDEP/DR is responsible for the investigation and remediation of uncontrolled hazardous substance sites throughout Maine. In the course of these investigations, samples must be taken to determine the geographical extent, chemical characteristics, and relative levels of contaminants at and in the vicinity of each site. This standard operating procedure (SOP) is designed to be a guideline for MEDEP/DR staff for collecting groundwater samples from monitoring wells using the low flow (minimum stress) purging and sampling procedure (LFS). This procedure is based on current research and field experience by MEDEP personnel. In addition to this SOP, it is recommended that personnel performing LFS review the published articles on this technique listed in Section 12, References, before attempting to perform the procedure for the first time.

3.0 RESPONSIBLITIES

LFS is the recommended methodology for obtaining groundwater samples from properly installed monitoring wells. Unless specific instances do not allow using low flow methodology, all MEDEP/DR staff must follow this procedure when performing groundwater sampling activities. The field staff in MEDEP/DR and geological support staff in MEDEP/Technical Services (MEDEP/TS) in particular must be well versed in LFS. Their managers and supervisors are responsible for ensuring that they receive adequate training, are familiar with, and adhere to this procedure. Other staff members who may assist with LFS will receive training on an as needed basis.

4.0 OVERVIEW OF LFS

The goal in any groundwater monitoring activity is to collect ground water samples that are "representative" of mobile organic and inorganic loads in the vicinity of the selected open well interval. Current research indicates that LFS is the best available technique for obtaining the most representative samples of groundwater from the formation surrounding the screened interval of a properly installed monitoring well.

LFS includes both a purge and no-purge option. The purge option for LFS involves pumping the well at a rate approaching ambient groundwater flow in order to minimize disturbance of the sampling zone and mixing of the riser water. Field parameters, such as pH and conductivity are monitored during purging until readings have stabilized; at this point (theoretically), groundwater entering the pump intake represents formation water and the sample is collected.

In low permeability formations or poorly installed monitoring wells it may not be possible to collect groundwater samples using the specified purge techniques. In such instances, the no-purge option should be evaluated.

Additionally, this procedure is not designed to collect samples from wells containing light or dense nonaqueous phase liquids (LNAPLs or DNAPLS).

LFS is a skill which requires considerable experience and ongoing education and tuning on the part of those who perform it; therefore, at least one experienced person in LFS should always accompany every sampling team.

5.O EQUIPMENT

The following list of equipment is necessary when performing LFS. Specific brand names indicate equipment owned by either MEDEP/DR and MEDEP/TS, and is available to staff for use. Deviations from this list must be indicated on the site specific sampling plan (see SOP DR#014, Development of a Sampling Plan).

Use of trademarked names does not imply endorsement by MEDEP/DR & /TS, only to identify the specific equipment owned by MEDEP/DR & /TS.

5.1 Pump

The pump selected must have capabilities of adjusting the flow rate without the use of flow restrictors. Types of acceptable pumps include: submersible and inertial pumps. The use of inertial pumps(e.g.peristaltic pumps) is permissible for most situations where the contaminants of concern have appropriate vapor pressures. Physical limitations on the use of peristaltic pumps also apply to wells with deeper water levels; wells with water levels greater than approximately 24 feet cannot be sampled with a paristaltic pump. In these instances, a submersible pump should be used.

Pumps available to MEDEP/DR personnel include Grundfos® submersible pumps, Fultz® submersible pumps, and Geotech® peristaltic pumps. Specific manufacturers' instructions are kept with the MEDEP/DR field staff, or the MEDEP/TS Geologist Technician.

The Department recommends the use of dedicated equipment, where possible, for long term monitoring plans.

5.2 Tubing

The goal in proper tubing selection is to maximize the tubing diameter, while minimizing the tubing length. Polyethylene is acceptable for all types of sampling. One quarter (¼) inch inside diameter (ID) tubing is the standard size used in conjunction with peristalitic pumps. Three eighths (3/8) inch ID tubing is the size used with the submersible pumps.

As in the case with pumps, the use of dedicated tubing, where possible, will be used for long term monitoring programs.

5.3 Power Supply

The power supply includes a generator, deep cycle battery, or nitrogen tank for running the pump(s). The Fultz and Geotech pumps owned by the MEDEP/DR/TS can be operated by deep cycle battery (the Fultz requires an electrical converter supplied with the pump). The Grundfos requires a

generator. If a gasoline generator is used, it must be located downwind and at a safe distance from the well so that the exhaust fumes do not contaminate the samples. The operator of the generator should not handle the sampling equipment or sample containers.

5.4 Indicator parameter monitoring instruments

The analyses necessary for LFS are listed below.

-- pH (EPA Methods 150.1 or 9040),
-- turbidity (EPA Method 180.1),
-- specific conductance (EPA Methods 120.1 or 9050),
-- temperature (EPA Method 170.1),
-- Oxidation Reduction(Eh), and
-- dissolved oxygen (EPA Method 360.1).

A flow-through cell is required for dissolved oxygen and Eh measurements.

5.5 Water Level/Flow Measuring Tools

Water level and flow measurement are required for LFS. Several different water level meters, including Solinist® and Well Wizard®, are available to staff. A graduated cylinder and stopwatch are used for measuring flow in mL/minute.

5.6 Documentation Supplies

This includes a field notebook for taking field notes, and LFS data sheet, which can be found in attachment A.

5.7 Well Documentation

A well's location, well construction, previous sampling data, and the Sampling and Analysis Plan (SAP) should accompany samplers in the field.

5.8 Miscellaneous Supplies

Miscellaneous supplies include decontamination equipment and material, sample bottles, preservation supplies, sample tags and labels.

6.0 LFS PURGE AND SAMPLE PROCEDURE

6.1 Preparation

Prior to conducting a low flow sampling event, information regarding well construction, development, and water level records for each well to be sampled should be obtained and reviewed to determine the appropiate pump to be used, locating the intake, and the potential groundwater recharge rate of the well. If this information is not available, a reconnaissance should be made prior to the actual sampling event to determine well depth, water level, lenghth of screen, and an pump test to determine the recharge rate of the well. Additionally, wells that have not been sampled for two years should be redeveloped prior to conducting the actual sampling event.

6.2 Field Procedure

Obtain static water level. Measure and record the depth to water (to 0.01 ft) in the well to be sampled before any disturbance to the well. Care should be taken to minimize suspension of any particulates attached to the sides or at the bottom of the well.

Install sampling pump or tubing. It is highly preferable that sampling tubing and pumps be dedicated to wells. However, in situations where dedicated equipment is not used, field staff will lower equipment., i.e., pump, safety cable, tubing and electrical lines, slowly into the well so that the pump intake is located at the center of the saturated screened interval (information regarding well construction must be included with sampling plan). When conducting sampling events at sites in which both peristaltic and submersible pumps are used, it is best to plan to install the submersible pumps, then collect samples from “peristalticable” wells, then return to sample the wells with submersible pumps. If the sampling event is multiple day, then submersible pumps should be installed in wells to sit overnight. Collection of turbid free water samples may be difficult if there is three feet or less of

standing water in the well. A water level indicator is next lowered to the top of groundwater.

When starting the pump, slowly increase the pump speed until a discharge occurs. Check water level. Adjust pump speed until there is little or no water level drawdown. It is best to concentrate on the flow rate and water level stabilization before connecting the flow cell or obtaining any other measurements. Air captured in the tube can usually be removed by elevating the discharge tube and pump to allow the air to continue rising until discharged with the water. Subsequent sampling rounds will probably have intake settings and extraction rates that are comparable to those used in the initial sampling rounds; check previous data sheets to assist in well set up and establishing flow rates.

Monitor water level and pumping rate every three to five minutes during purging. Record pumping rate adjustments and depths to water. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time. If the recharge rate of the well is less than minimum capability of the pump do not allow the water level to fall to the intake level (if the static water level is above the screen, avoid dewatering the saturated screen). If a constant water level can not be maintained at a flow rate of 80 to 100 mL/min., the no-purge option should be evaluated(see Section 9.0 No-Purge Option).

During well purging, monitor field indicator parameters every three to five minutes. Purging is complete and sampling may begin when all field indicator parameters have stabilized (variations in values are within ten percent of each other, pH +/- 0.2 units, for three consecutive readings taken at three to five minute intervals). Measurements of dissolved oxygen and Eh must be obtained using a flow-through cell. Samples for laboratory analyses must be collected before the flow cell. This can be done by disconnecting the flow cell after reaching stabilization, or by providing a sample port before the flow cell. If any measurements are missing, the resulting sampling data may not be acceptable. The current approved data sheet for low flow sampling can be found in Attachment B.

VOC samples are preferably collected first and directly into preserved sample containers. Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence. Preserve all

samples (if applicable) immediately after they are collected.

LFS will help eliminate turbidity caused by improper purge and sampling techniques. The need for filtering water samples will be reduced by using this method. However, if turbidity values equilibrate above 30 NTUs, one should consider the need to collect both a filtered and an unfiltered sample. The use of an in-line filter is preferred. An in-line 0.2-0.45 um particulate filter should be pre-rinsed with approximately 25 - 50 mL of groundwater prior to sample collection, or as per filter manufacturers instructions. **Note that filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations representative of total mobile loads.**

After collection of the samples, any tubing used may either be dedicated to the well for resampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

7.0 PROCEDURE EVALUATION

The purpose of the LFS purge option is to sample the groundwater from the surrounding aquifer. If your well is not receiving sufficient recharge from the formation, the water level in the well will drop as pumping continues. This means that the discharge water could contain a significant percentage of stagnant water from the well casing. As the percentage of casing water increases, the representativeness of the sample decreases. If the percentage of casing water is significant, an alternative sampling technique, such as the No – Purge Option, should be considered (see Section 9). A Decision process for implementing low flow/no purge sampling can be found in Attachment A.

The second step in evaluating the viability of LFS for a potential no - purge well is to determine the volume of groundwater needed to fill the laboratory containers. Compare this volume to the volume of groundwater in the screened section of the monitoring well. If the volume of water contained in the screened zone is greater than the volume of sample required to fill the sample containers, then the no-purge option is appropriate for this well.

7.1 Calculating Formation/Stagnant Water Ratio

The following calculation will determine how much of the water being pumped is coming from the well, and how much is coming from the aquifer. This is done by comparing the total volume being purged to the drawdown volume in the well. If the equilibrium flow rate is 150 mL/min or lower for a given well, the following evaluation should be followed:

-- Calculate the total volume of water discharged for a given time interval.
-- Measure the total drawdown of the water level in the well during that time interval.
-- Calculate the total drawn down volume in the well.(For a two inch diameter well there are ~660 mL/foot.)

Compare the total volume of water discharged to the total drawdown volume. If the drawdown volume comprises 60% or more of the discharge volume, the well construction should be evaluated.

7.2 Well Construction Evaluation

Evaluate the well construction. Was the appropriate screen slot size selected? Was the appropriate filter sand selected? If the well construction details are not appropriate for the formation then consideration should be given to installing a new, properly designed well. A poorly designed well will not yield representative samples no matter what purging procedure is utilized.

Any sampling of wells that have not been used for more than three years should be reconnoitered to determine if re-development is necessary before attempting to sample with LFS.

8.0 PROCEDURE MODIFICATIONS

The LFS procedure can be modified to meet the Data Quality Objectives for the Sampling Event. In long-term monitoring events it may be possible to reduce the field parameter list after baseline information is obtained over the first year or two. Careful consideration should be given to the purpose of each parameter used in the procedure. Each

parameter has importance that extend beyond the measurement for equilibrium.

Cold weather considerations must be factored into a low flow sampling plan.

Monitoring wells with recharge rates below 100 mL/min may not be capable of being pumped at a continuous rate. Therefore, low purge or no purge options should be considered.

9.O NO – PURGE OPTION

The theory of no-purge sampling is that the water in the screened zone is in equilibrium with the aquifer and the water in the riser portion of the well is not. The goal is to sample only the water in the screened zone and to minimize any mixing with the water in the riser.

In certain low permeability formations it may not be possible to maintain a constant drawdown at low flow rates(~80-100 mL/min.). In these formations the only option may be to obtain a groundwater sample without purging.

9.1 No-Purge Procedure

The same principle applies to the no-purge option that apply to the purge option. Dedicated equipment is required to properly complete this procedure(to eliminate any additional mixing of the water in the riser with the water in the screen).

The pump intake must be in the screened zone, at or slightly above the midpoint of the screen.

Calculate the volume of water standing in the discharge line.

Turn on the pump at the lowest possible flow rate.

Purge the volume of water that was standing in the discharge line.

Immediately begin sample collection after the discharge line is purged.

10.0 DOCUMENTATION

A field log must be kept each time ground water monitoring activities are conducted in the field; the LFS Data Sheet in Attachment B is the approved form for use by staff. The

field log should document the following:

-- Well identification, condition of well
-- Static water level
-- Pumping rate, or flow rate including units
-- Time of all measurements
-- Water Level at the specified pumping rate
-- Indicator parameters values
-- Well sampling sequence and time of sample collection.
-- Types of sample bottles used and sample identification numbers.
-- Preservatives used.
-- Parameters requested for analysis.
-- Name of sample collector(s).

Calibration information of meters should also be documented.

11.0 DECONTAMINATION

Dedicated equipment will not need decontaminating. However, non dedicated equipment should be cleaned prior to field work, after each sampling location, and upon return to the office from the field. Non dedicated tubing should be discarded. The pump, including support cable and electrical wires which are in contact with the well will be decontaminated by one of the procedures listed below.

The decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump or the pump can be disassembled and flushed with the decontaminating solutions. It is recommended that detergent and isopropyl alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is flushed out. The outside of the pump and the electrical wires must be rinsed with the decontaminating solutions as well. The procedure is as follows:

-- Flush the equipment/pump with deionized or tap water. Flush pump by allowing pump to run with water for several minutes in basin filled with water.

-- Flush with non-phosphate detergent solution for several minutes.

-- Flush with deionized water to remove all of the detergent solution. In some instances of high levels of contamination, it may be appropriate to use isopropyl alcohol in this step. The need for this will be determined in the Site Specific Sampling and Analysis Plan (See SOP DR#014)

-- Flush one final time with distilled/deionized water. If required (as determined in Site Specific Sampling and Analysis Plan), collect equipment blank after final flushing.

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ATTACHMENT A
DECISION PROCESS FOR IMPLEMENTING LOW FLOW/NO PURGE SAMPLING

Decision Process for Implementing LFS

1) Obtain well construction, development, and water level records for each well being sampled. Compile total depth, screened interval, water level, and available hydraulic conductivity information for field technician(s).
   Continue to 2

2) Review available equipment. Make sure the pump is capable of variable speeds and can pump water at low rates without the use of mechanical flow restrictions. Reducing flow by altering the diameter of the discharge pipe is not acceptable for purposed of LFS. Make sure the chamber being used to collect field parameters is appropriate for the parameters being measured. For Eh and DO measurements with probes, the chamber must be an enclosed chamber that does not allow water to contact the atmosphere and does not impact the water quality. Additionally, the size of the chamber should be appropriate given the expected flow rates.
   Continue to 3

3) The objectives of the sampling event should be reviewed to determine the important stabilization parameters as well as the important field parameters for geochemical analyses.
   Continue to 4

4) Is the well being used as part of a long-term plan to monitor trends in groundwater chemistry?
   Yes … Go to 5
   No … Go to 6

5) Complete Well Performance Evaluation on Well prior to first sampling event.
   Continue to 6

6) Will water level (under pumping conditions) stabilize above the top of the screen?
   Yes … Go to 11
   No … Go to 7

7) Is the static water level above the top of the screen?
   Yes … Go to 9
   No … Go to 8

8) Will the stabilized water level reduce the volume of water in the well by greater than 10%?
   Yes … Go to 12

No … Go to 11

9) Is there sufficient water in the well to purge and sample the well given the measured drawdown rate without dewatering any part of the screen?
   Yes … Go to 10
   No … Go to 12

10) Is the volume of water attributable to the change in water level greater than 20% of the volume of water being discharged during the same time period?
   Yes … Go to 12
   No … Go to 11

11) Complete the Standard Low Flow Sampling Procedure and collect groundwater samples once the selected stabilization parameters have equilibrated.

12) Evaluate the appropriate application of Reduced Purge Procedures for this well.
   Continue to 13

13) Is the sampling equipment (pump or sample tube) dedicated to the well and/or has it been installed for more than 2 weeks prior to sampling?
   Yes … Go to 15
   No … Go to 14

14) Install the pump or tubing and purge a volume of water equal to 1.5 times the volume required to fill the laboratory containers. Purging must be completed at the lowest setting possible (must be less than 100 mL/min). Then shut-off the pump and allow the well to recharge until the water level returns to the static water level
   Continue to 15

15) Set the pump rate to the lowest possible setting (must be lower than 100 mL/min) and purge a volume of water equal to the volume of water in the sample tube. Then immediately begin collection of laboratory samples at the same rate. Record the water level at the beginning of sample collection and at the end of sample collection. If field parameters are to be collected, they must be collected after laboratory samples are collected.

Monitoring Well Purge and Sample Data Sheet

Well#

Date

Static Water Level

Begin Time of Purge

Site Name

Total Depth | Well Diameter

Screen Interval | Formation | Sample Device

Time	Water Level	Flow	DO	Temp.	Cond.	pH	ORP	Turb.	
Min.	Feet below MP	mL/Min	mg/L	Celcius		-log[H+]	mV	NTU	
Write Meter Number of Instrument Used									**Comments**

Equilibrium Goals

3 consecutive readings 3-5 min. apart

Flow 1-2 mL/Min	Cond. +- 3%
Water Level +- 0.01	pH +- 0.1
DO +- 10%	eH +- 10 mV
Turb +- 10%	Temp. +- 0.1

Eh Correction for Ag/AgCl probe:

Add 199 mV to ORP value

mL/Ft Information

3/4 in well = 87 mL/Ft

2 in well = 617mL/Ft

4 in well = 2470 mL/Ft

Record all instrument calibrations in Instrument Calibration Log Book or Field Book

Date Revised 1/28/2002

Samplers:

Laboratory Sample Numbers

Analysis / Depth	Number

Department of Environmental Protection
Bureau of Remediation & Waste Management
RCRA Program

Standard Operating Procedure Change Record

Title: SURFACE WATER AND SEDIMENT SAMPLING PROTOCOL

Identification #: DR04

SOP Originator: Brian Beneski

Author	Revision	Description of Change	Date
Deb Stahler	RCRA 01	Substitute MEDEP/RCRA in the place of MEDEP/DR, and Division of Oil and Hazardous Materials in the place of Division of Remediation. Section 2.0 Introduction: Change first sentence to "MEDEP/RCRA is responsible for the investigation and subsequent corrective actions for RCRA facilities throughout Maine." Section 7.0 Quality Assurance/ Quality Control: Add sentence - "Preserve all samples according to guidelines in SAMPLING CRITERIA FOR METALS AND ORGANIC COMPOUNDS.	5/31/02

Approved by:

_____

Scott Whittier, RCRA Program Director Date:

SURFACE WATER AND SEDIMENT SAMPLING PROTOCOL

Maine Department of Environmental Protection

Division of Site Remediation

Standard Operating Procedure: DR#004
REVISION: #2
DATE: May 14, 1999
Written/Revised by: Brian Beneski
Reviewed by: Jean Firth

1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Site Remediation (MEDEP/DR) standard operating procedure (SOP) for collecting surface water and sediment samples from streams, rivers, ponds, lakes, lagoons, surface impoundment's and other surface water bodies throughout the State of Maine.

2.0 INTRODUCTION

MEDEP/DR is responsible for the investigation and remediation of uncontrolled hazardous substance sites throughout Maine. In the course of these investigations, samples are sometimes taken to determine the extent of contamination within the surface water bodies of Maine. This standard operating procedure (SOP) is designed to be a guideline for MEDEP/DR staff for collecting samples of surface water and sediment chemical analysis. This procedure is based on current methodology guidelines and field experience of MEDEP personnel.

Collecting a representative surface water and/or sediment samples is often difficult because of many factors associated with water bodies. In moving surface water systems, for example, mixing and flow rate may effect the sample. In standing surface water systems, stratification and lack of significant currents play a major role in the type of sampling to be proposed. This SOP identifies sampling protocols to be followed when collecting representative surface water samples. Sediment sampling presents the same challenges, given the changing depositional characteristics in rivers, streams, lakes and other surface water bodies. This SOP shall provide a guideline in to assure that environmental samples collected from surface water bodies are as representative as possible of the actual conditions within the surface water body itself.

3.0 RESPONSIBLITIES

All MEDEP/DR staff must follow this procedure when performing surface water and sampling activities. Generally, the field staff (OHMS positions) in MEDEP/DR conduct this type of sampling, although project managers may collect these types of samples in specific instances if accompanied by, or once appropriately trained in, this methodology when use of powered water craft are not required. The respective managers and supervisors for MEDEP/DR are responsible for ensuring that their staff receive adequate training, are familiar with, and adhere to these procedures.

4.0 EQUIPMENT

The following is a list of equipment currently owned and available to MEDEP/DR staff for collecting samples of surface water and sediment. The users manual for this equipment are is in the custody of the MEDEP/DR Oil and Hazardous Materials II staff. This SOP will be updated as new equipment is purchased by MEDEP/DR.

4.1 Equipment for Surface Water

- Kemmerer sampler - A messenger activated water sampling device which is able to sample water at discrete locations in a column of water. The Kemmerer sampler is a vertically oriented sampler, and is applicable forcollecting stratified water column samples.
- Beta sampler - messenger activated water sampling device that is horizontally oriented. The Beta sampler is applicable for collecting samples from the bottom of a surface water column, as well as being able to collect discrete samples at different depths of the water column.

Additional collection devices can also be used for obtaining samples of water (such as a sample container itself, or a container tied to a clean rope, or other "container" type device); any custom made tool must be described in either the sampling plan or trip report for the particular sampling event.

4.2 Equipment for Sediment Sampling

The following equipment is available to MEDEP/DR staff for collecting sediment samples.

- Ponar grab - A self closing center pivot benthic grab sampler used for taking samples of hard bottoms such as sand, gravel, rocky, or clay.
- Ekman Grab - A center pivot benthic grab sampler used for obtaining samples in soft, finely divided littoral bottoms.
- Geoprobe Systems Large Bore sampler - A soil boring device used usually for boring in soil, but can also be used in sediment sampling. See MEDEP/DR SOP DR#007 - Soil Sampling with a Geoprobe Large Bore Sampler for use of this item.
- Shovel - A general garden type spade.

Additional "digging" type tools can also be used for obtaining samples of sediment; any custom made tool must be described in either the sampling plan or trip report for the particular sampling event.

5.0 GUIDELINES/PROCEDURES FOR SURFACE WATER AND SEDIMENT SAMPLING

5.1 Preparation

Before undertaking any surface water or sediment sampling at a site, a site and event specific Sampling and Analysis Plan (SAP) and/or Quality Assurance Project Plan (QAPP) should be developed (see SOP DR#014 - Development of a Sampling and Analysis Plan and SOP DR3016 - Requirements for the Development of a Site Specific Quality Assurance Project Plan). A SAP for a surface water sampling event should specify the sample collection tools and means of accessing the sample points.

There are 3 means of accessing surface water for collection of water column and sediment samples: 1) Dipping from shore or surface water crossing; 2) Wading into the surface water body; and 3) Boat access. The .size of the water body will generally dictate the means of accessing the sampling points. Means of access generally dictates the equipment for collecting samples as well. In instances of sampling a shallow stream, it is possible to obtain the desired samples by dipping the containers directly into the water body from shore. At larger streams or ponds, entering the surface water with boots or waders may be the safest and easiest way to collect a representative sample, provided depth of water and

strength of the current are not prohibitive. In such instances, a safety line should be attached to the sampler entering the surface. The sampler .must make sure the boots/waders are not leaking and are compatible with the potential contaminants in the surface water body. Samples can then be collected by either direct dipping with the container or with a separate sample collection tool.

For sampling larger rivers and lakes, a boat most likely will be needed in order to obtain the desired samples. If a boat is used by members of the SIR Division, the boat must be appropriately equipped with proper safety gear/equipment as specified by the Coast Guard, including personal flotation devices (one per person), anchors, flares, etc. If the boat used is a has a gasoline powered engine, then one member of the sampling team should be dedicated to operation of the motor, to prevent contamination of samples with gasoline and oil. The staff member operating the boat must be trained and/or have experience in using a similar craft.

When accessing the surface water for sample collection, safety considerations should be paramount. If possible, pick a good, safe spot on the shore/bank of the surface water where the shore/bank is stable and the sampler is not likely to fall in the water. If the sampler cannot safely sample from the shore/bank and must enter the surface water body in order to obtain a representative sample, the sampler must, when possible, take precautions to enter the water from a downstream location and must always collect the sample from an upstream location. When sampling a surface water body, be careful to sample water which doesn't contain sediments that the sampler has disturbed. Make sure to wear the appropriate personnel protective equipment (i.e., gloves) for the contaminants potentially in the water.

5.2 Special Considerations

5.2.1 Special Considerations for Flowing Water

In addition to safety considerations of flowing water, the sampling of moving surface water, such as streams, rivers, estuaries, and drainage ditches, uses different strategies and techniques for sampling than does standing surface water. With moving surface water there will be more mixing and less stratification than in standing surface water. Discharge

points, merging streams, springs, and the presence of pools and eddies must also be considered when sampling moving surface water. A reconnaissance of all sampling points is recommended before conducting the actual sampling. All sampling points should be clearly marked to assure consistency in sampling rounds.

After selecting representative sampling points which adequately address the sampling objectives, decide how many samples to take and what type of analyses are appropriate. Samples should be collected directionally from downstream sites to upstream sites to avoid disturbing water that is to be sampled. If these precautions are taken, the sample should be free of any sediment and/or contaminants stirred up by the sampler. The location of the samples depends directly on what the objectives of the sampling event are and are dependent on the specifics of the site (as long as the sample can be safely obtained).

5.2.2 Special Considerations for Standing Water

The sampling of standing surface water, such as ponds, lakes, lagoons, and impoundments, is different from the sampling of moving surface water because standing surface water often is stratified and zoned within the surface water body. The lack of movement results in very little mixing, therefore requiring more sampling points than moving surface water.

In a standing surface water body, the section nearest the source of contamination is likely to be the area of highest contamination. The sampler might also expect a vertical stratification of contamination due to a lack of mixing.

5.3 Sampling Procedures

5.3.1 Dipping Containers

In many instances, SIR Division members will be sampling a surface water body from the shore/bank of the surface water body. Because of this fact, the sample container will usually be the easiest piece of equipment to use to collect the sample. Using the actual sample container to take the sample eliminates most of the chance of cross-contaminating samples (by unnecessary transfer of samples from a sampling device to a sample container) and also eliminates the need for extensive

decontamination of sampling equipment. Dip the sample container just below (1 inch) the surface of the water, with the opening of the container pointing upstream. Remember, however, that the outside of the sample container should be clean prior to sampling, and wiped dry or if necessary, decontaminated (see SOP'DR#017: Decontamination of Equipment Used at Uncontrolled Hazardous Substance Sites) prior to being placed in a cooler with other samples.

5.3.2 Sampling Using Kemmerer or Beta

Use of the Kemmerer or Beta is for the most part intuitive. After opening and cocking the sampling device by pulling the plugs located on either end, lower the device to the desired depth of sample collection and then send the messenger down the rope to spring the device. After retrieving the sampler, fill containers from the spigot located on the side of the sampler. Once sample collection is complete, the sampler should be decontaminated before being used at the next sampling location.

5.3.3 Other Equipment

In the SIR Division, samplers can choose dippers with long-handled poles, buckets with string attached, and extended bottle samplers. This type of equipment is generally "homemade", and built for a specific sampling event. Use of this type of "exotic" equipment will be outlined within the SAP for the sampling event, as well as in the Sampling Event Trip Report (SETR) for the event (see SOP DR#013 - Field Documentation and SETR Development).

6.0 GUIDELINES FOR SEDIMENT SAMPLING

Both the Ponar and Ekman Dredge are, for the most part, intuitive in there use. After opening the "jaws" of the device, the sampler is then locked open with the spring mechanism, and lowered to the sediment to be sampled. It is better to lower the device slowly, hand over hand with the rope, rather than to just drop the sampler into the water. Upon impact, the spring mechanism should release, and the jaws close to collect the sample. The sampler is then raised to the surface, and after draining excess water, the sampler is opened and contents emptied into a clean bowl. Containers are

then filled using spatulas or appropriately chemical resistant gloves.

Shovels are for the most part intuitive in their use as well. After "digging up" the sediment sample, the sample is then containerized appropriately.

Refer to MEDEP/DR SOP "DR#007 - Soil Sampling with a Geoprobe Large Bore Sampler", for use of the geoprobe for sampling.

All equipment should be decontaminated between sampling points. Samples should also be collected from areas that are believed to be least contaminated to areas of greater concentration. As with surface water sampling, sampling points should be approached from downstream, and care must be taken not to step into the area of sample collection when wading.

6.1 Other Issues pertaining to Sediment Sampling

An attempt should be made to obtain sediment samples that are similar in there organic content and formation, i.e, silty, sandy, clay, etc. Excess organic material, such as leaves, roots, and larger aquatic organisms (starfish, slugs, clams, beach goers) should be removed from the sample prior to containerization.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

The sampling plan or QAPP (MEDEP/DR SOP DR#014 and DR#016) should outline the data quality needs for the event.

8.0 DOCUMENTATION

Documentation is the most important aspect of any sampling event, but even particularly so with a surface water/ sediment sampling event. Documentation should be completed with the idea that someone not present during the actual event may need to repeat the event exactly as was conducted originally. During the sampling event or immediately upon the completion of the event, diagram a map of the area and locate the sampling points (and corresponding sample container numbers) on the map. Also record observational data concerning the surface water such as relative depth at the sampling point,

odor, color, turbidity, and relative velocity (low, medium, or high). Make sure to record in your personal field book any and all information which is pertinent to the sample. Refer to the MEDEP/DR SOP DR3013 - Documentation of Field Notes and Development of a Sampling Event Trip report. It is very important that all information regarding a sampling event (or any events/activities) be accurately recorded. Record all information obtained while sampling such as sample numbers, measurements taken (i.e., pH, conductivity, temperature, etc.), observations made (i.e. turbidity, color, and odor of the water) and other comments (problems with the sampling, why certain areas were not sampled). A trip report package should also be completed for the event, as outlined in MEDEP/DR SOP DR#013.

When checking in samples at the laboratory for analysis, a Chain of Custody (COC) form must be properly filled out; refer to the MEDEP/DR SOP DR#012 - Chain of Custody Documentation for requirements for COC protocol.

9.0 HEALTH AND SAFETY

As part of the overall work plan at a hazardous substance site, a site specific health and safety plan (HASP) must be developed and adhered to by all personnel working at the site. Refer to MEDEP/DR SOP DR#014 - Development of a Sampling and Analysis Plan.

All personnel must understand that if a sample can not be obtained safely, the sample should not be taken at all. If a sample cannot be obtained due to safety considerations it should be documented in the sampler's field book.

Department of Environmental Protection
Bureau of Remediation & Waste Management
RCRA Program

Standard Operating Procedure Change Record

Title: **PROTOCOL FOR COLLECTION AND HANDLING OF SOIL AND SEDIMENT SAMPLES FOR VOLATILE ORGANIC ANALYSIS**

Identification #: DR05

SOP Originator: Brian Beneski

Author	Revision	Description of Change	Date
Deb Stahler	RCRA 01	Substitute MEDEP/RCRA in the place of MEDEP/DR, and Division of Oil and Hazardous Materials in the place of Division of Remediation. Section 2.0 Introduction: Change first sentence to "MEDEP/RCRA is responsible for the investigation and subsequent corrective actions for RCRA facilities throughout Maine."	5/31/02

Approved by:

_____

Scott Whittier, RCRA Program Director Date:

PROTOCOL FOR COLLECTION AND HANDLING OF SOIL AND SEDIMENT SAMPLES FOR VOLATILE ORGANIC ANALYSIS

Maine Department of Environmental Protection
Division of Site Remediation

Standard Operating Procedure: **DR#005**
Revision: **1**
Date: **March 28, 2000**
Written by: **Brian Beneski**
Reviewed by: **Jean Firth**

1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Remediation's (MEDEP/DR) procedure for collecting and handling soil/sediment and other "solid" material for volatile organic compound (VOC) analysis.

2.0 INTRODUCTION

MEDEP/DR is responsible for the investigation and remediation of uncontrolled hazardous substance sites throughout Maine. In the course of the investigation and subsequent remediation, samples must be taken to determine the geographical extent, chemical characteristics, and relative levels of contaminants at each site and surrounding area. This standard operating procedure (SOP) is designed to be a guideline for containerizing solid matrix VOC samples that will be analyzed using USEPA proposed methods 5035 and 5021. These particular methods require that samples collected in the field be preserved at the time of collection through either chemical (methanol or sodium bisulfate) or physical (freezing) means. This SOP will outline the procedure for preservation using both methods.

3.0 RESPONSIBILITIES

All Uncontrolled Sites Program Staff must following this procedure when collecting solid matrix samples for VOC analysis. All managers and supervisors within MEDEP/DR are responsible for ensuring that their staff are familiar with and adhere to this procedure.

4.0 PROCEDURE FOR CHEMICAL PRESERVATION

4.1 Preparation

Prior to conducting any sampling event, a sampling plan should be developed (see SOP DR#014 - Development of a Sampling and Analysis Plan). The Maine Department of Health and Human Services' Health and Environmental Laboratory (HETL) will be providing all VOC analysis services to MEDEP/DR. A copy of their Quality Assurance Plan can be found in the MEDEP/DR's Quality Assurance Plan (QAP). HETL will be providing appropriate containers for analysis; prior to conducting any sampling HETL will be contacted and appropriate containers procured from the lab. If another laboratory other the HETL is used, the laboratory must use the same method as HETL for analysis and provide MEDEP/DR a copy of there SOP for conducting the analysis. Fresh containers must be obtained from the laboratory for each sampling event.

4.2 Equipment

Equipment required for solid VOC sampling include:

-- Sampling device - This includes shovels, Geoprobe soil boring system, dredges, etc, as outlined in the site specific sampling plan. Please refer to the following MEDEP/DR SOPs for using this equipment:

-- DR#004 - Sampling Surface Water and Sediment
-- DR#006 - Soil Sampling
-- DR#007 - Soil Sampling with a Geoprobe Large Bore Sampler

-- Sample collection syringe - A disposable open barrel (without Luer - tip end) plastic syringe for sampling, or a Terra Core™ sampler. A five (ml) syringe is required; larger syringe sizes will not fit into the vial and therefore make containerization impossible. Syringes having rubber or other elastomer seals are not acceptable. Syringes with rubber seals can have the rubber seal removed prior to use.

-- Sample containers - Three containers will be provided by the lab:

1) One 40 ml VOA vial, containing sodium bisulfate preservative and a clean teflon magnetic stirring bar. There should be enough sodium bisulfate to ensure a sample pH of < 2; therefore 1 gram will be added for a five gram sample. The container with preservative and stirring bar must be pre weighed by the laboratory to nearest hundredth of a gram, with tare weight written on container label. Note: when using sodium bisulfate as a preservative, acetone may be formed and samples with carbonates will cause foaming when added to vial.

2) One 40 ml VOA vial, containing 10 ml of methanol and a clean teflon coated magnetic stirring bar. The container with preservative and stirring bar must be pre weighed by the laboratory to nearest hundredth of a gram, with tare weight written on container label.

3) An additional container for conducting dry weight analysis. The only requirement for this container is that it be able to contain at least 10 grams of sample. A plastic whirl pack container will suffice.

-- Field balance - optional.

4.3 Sampling Procedure

1) Prepare sampling syringe and containers for use. Visually confirm presence of preservative, stirring bar, and tare weight on container. Retract plunger of the coring syringe leaving barrel space for the desired soil sample volume (approximately 3.5 ml). To assure that the sample is as close to five grams as possible, it is recommended the a

"test" soil sample be collected and weighted on the field balance to determine the appropriate amount in the syringe to collect.

2) Using chosen sampling device, obtain soil sample. Samples should be collected as soon as the soil has been exposed to the atmosphere. Expose the sample site (i.e. open the soil borer, dig hole and expose soil sidewall, open dredge, etc.), and quickly collect the soil sample by pushing syringe into soil until approximately 5 grams of soil is obtained (approximately 3.5 ml on syringe scale). When obtaining samples with trowels, shovels, and backhoes, it is preferred that the sample be obtained directly from the side walls or bottom of the hole or excavation rather than the device itself. **However, personnel must not put themselves at risk; no personnel should be entering any excavation deeper than 4 feet or that would in any way be considered a confined space. Do not put your head in excavations or holes that may contain toxic environments.** In some instances, such as sediment sampling, it is impossible to collect directly from the environment. If collecting a sample from the device (i.e., shovel, ponar dredge) itself, every attempt should be made to obtain the sample from undisturbed soil; i.e. try to keep the soil/sediment as a "clod" in the shovel or backhoe and push the syringe into the undisturbed clod.

3) Transfer soil from syringe into one of the vials provided by laboratory. Clean off outer syringe barrel before putting into vial. Seal immediately. Repeat procedure for second vial.

4) Completely disperse samples in preservative by shaking to produce a slurry. Transport cohesive clay soils that do not disperse well in the field to the laboratory as soon as possible, and instruct the laboratory to disperse the sample by appropriate means (i.e., sonication) immediately upon receipt. Note the need for dispersal on the chain of custody form(s).

5) Collect sample for dry weight analysis. Sampling syringe is not necessary for obtaining this soil; soil may be placed directly into container with trowel or appropriately gloved hand.

6) Place samples in iced cooler. Clean the outside of each sample container before placing in the shipping/storage container. Temperature of cooler should be maintained at approximately 4°C.

4.3.1 Special Requirements for Samples With Expected Low Percent Solids

Samples with high moisture content (and consequently low percent solids) will require a sample mass greater than 5 grams. It is therefore recommended that when samples are anticipated to have percent solids less than 30%, as in the case of sediment samples, an extra vial be procured (in addition to the 3 other containers) from the lab that has enough sodium bisulfate to ensure a pH of <2. A sample size of 15 grams will be collected, therefore 3 grams of sodium bisulfate will be added by the laboratory. This vial must be clearly marked as containing extra preservative. As with the other vials, a teflon coated

metal stirring bar must also be in the vial and the entire container with preservative and stirrer pre weighed by the lab. Sampling procedure will be the same as the other vials, except that the syringe will be used three times in collecting the sample for containerization to obtaining the necessary 15 gram sample. Additionally, free liquid should be decanted from the sample prior to sample collection with syringe when appropriate.

5.0 PROCEDURE FOR PHYSICAL PRESERVATION

5.1 Preparation

Prior to conducting any sampling event, a sampling plan should be developed (see SOP DR#014 - Development of a Sampling and Analysis Plan). The Maine Department of Health and Human Services' Health and Environmental Laboratory (HETL) will be providing all VOC analysis services to MEDEP/DR. A copy of their Quality Assurance Plan can be found in the MEDEP/DR's Quality Assurance Plan (QAP). HETL will be providing appropriate containers for analysis; prior to conducting any sampling HETL will be contacted and appropriate containers procured from the lab. If another laboratory other the HETL is be used, the laboratory must use the same method as HETL for analysis and provide MEDEP/DR a copy of there SOP for conducting the analysis. It is recommended that fresh containers be obtained from the laboratory for each sampling event.

5.2 Equipment

Equipment required for solid VOC sampling include:

-- Sampling Device - This includes shovels, Geoprobe soil boring system, dredges, etc, as outlined in the site specific sampling plan. Please refer to the following MEDEP/DR SOPs for using this equipment:

-- DR#004 - Sampling Surface Water and Sediment
-- DR#006 - Soil Sampling
-- DR#007 - Soil Sampling with a Geoprobe Large bore sampling

-- Sample collection syringe - A disposable open barrel (without Luer - tip end) plastic syringe for sampling, or a Terra Core™ sampler. A five (ml) syringe is required; larger syringe sizes will not fit into the vial and therefore make containerization impossible. Syringes having rubber or other elastomer seals are not acceptable; syringes with a rubber seal can be used if the seal is removed prior to use.

-- Sample containers - Three containers will be provided by the lab:

1) Two 40 ml VOA vial, containing a clean teflon coated magnetic stirring bar. The containers with stirring bar must be pre weighed by the laboratory to nearest hundredth of a gram, with tare weight written on container label.

2) An additional container for conducting dry weight analysis. The only requirement for this container is that it can contain at least 10 grams of sample. A plastic whirl pack container will suffice.

-- Dry ice and freezing cooler. Dry ice requires special handling. Staff may not use dry ice until they have received appropriate training and equipment for handling dry ice.

-- Balance - Optional.

5.3 Sampling Procedure

1) Prepare sampling syringe and containers for use. Visually confirm presence of the stirring bar and tare weight on container. Retract plunger of the coring syringe leaving barrel space for the desired soil sample volume (approximately 3.5 ml). To assure that the sample is as close to five grams as possible, it is recommended the a "test" soil sample be collected and weighed on the field balance to determine the appropriate amount in the syringe to collect.

2) Using chosen sampling device, obtain soil sample. Samples should be collected as soon as the soil has been exposed to the atmosphere. Expose the sample site (i.e. open the soil borer, dig hole and expose soil sidewall, open dredge, etc.), and quickly collect the soil sample by pushing syringe into soil until approximately 5 grams of soil is obtained (5 ml on syringe scale). When obtaining samples with trowels, shovels, and backhoes, it is preferred that the sample be obtained directly from the side walls or bottom of the hole or excavation rather than the device itself. **However, personnel must not put themselves at risk; no personnel should be entering any excavation deeper than 4 feet or that would in any way be considered a confined space. Do not put your head in excavations or holes that may contain toxic environments.** In some instances, such as sediment sampling, it is impossible to collect the sample directly from the environment. If collecting a sample from the device (i.e., shovel, ponar dredge) itself, every attempt should be made to obtain the sample from undisturbed soil; i.e. try to keep the soil as a "clod" in the shovel or backhoe and push the syringe into the undisturbed clod.

3) Transfer soil from syringe into one of the vials provided by laboratory. Seal immediately. Repeat procedure for second vial.

4) Collect sample for dry weight analysis. Sampling syringe is not necessary for obtaining this soil; soil may be placed directly into container with trowel or appropriately gloved hand. Sample must be at least 10 grams in weight.

5) Place samples in cooler for freezing. Clean the outside of each sample container before placing in the freezing/shipping/storage container. Place the samples in the cooler so that an vial is leaning approximate 45° angle and so that the vials are not in direct

contact with dry ice. **Do not place samples for any other parameters in coolers containing dry ice.**

5.3.1 Special Requirements for Samples With Expected Low Percent Solids

Samples with high moisture content will (and consequently low percent solids) will require a sample mass greater than 5 grams. It is therefore recommended that when samples are anticipated to have percent solids less than 30%, as in the case of sediment samples, an extra vial be procured from the lab for collection of an extra sample. As with the other vials, a metal teflon coated stirring bar must also be in the vial and the entire container with stirring bar pre weighed by the lab. Sampling procedure will be the same as the other vials, except that a sample of approximately 15 grams will be collected. Therefore, the syringe will be used three times in collecting the sample. Additionally, free liquid should be decanted from the sample prior to sample collection with syringe when appropriate.

6.0 CHAIN OF CUSTODY

Procedures for chain of custody outlined in MEDEP/DR SOP DR#012 - "Chain of Custody" must be followed.

7.0 DOCUMENTATION

All sampling activities must be documented as outlined in MEDEP/DR SOP DR#013 - Documentation of Field Notes and Development of a Sampling Event Trip Report.

8.0 QUALITY ASSURANCE/QUALITY CONTROL

8.1 QA Sample Collection

Collection and analysis of the following QA samples is mandatory.

-- Trip Blank. One trip blank per sampling event. When using pre - preserved sample containers, a separate trip blank for sodium bisulfate and methanol should be utilized. Trip blanks should travel accompany containers at all times; each sample storage and shipping container should contain a trip blank. The laboratory providing analysis will re responsible for providing the appropriate trip blank.

-- Temperature Blank. A "temperature blank" shall be included in each cooler when utilizing the physical preservation protocol. This blank shall consist of a VOC vial filed approximately 1/3 with water and sealed. It will be placed in the freezing cooler upon leaving and kept in the cooler directly adjacent to the samples as the sampling event occurs. This blank will be visually checked on a periodic basis to assure that the cooler is

freezing samples. More ice will be added to the cooler if the temperature blank is not frozen. Inspections of temperature blank will be documented in field notes.

Any other QA/QC samples as outlined in the site specific sampling and analysis plan and/or site specific quality assurance project plan (see MEDEP/DR SOP DR#014 - "Development of a Sampling and Analysis Plan", and MEDEP/DR SOP DR#017 - "Requirements for the Development of a Site Specific Quality Assurance Project Plan").

8.2 Deviations from SOPs

All deviations from the procedures outlined in this or in any other SOPs followed for VOC sampling must be documented in field notes.

Department of Environmental Protection
Bureau of Remediation & Waste Management
RCRA Program

Standard Operating Procedure Change Record

Title: SOIL SAMPLING PROTOCOL

Identification #: DR06

SOP Originator: Brian Beneski

Author	Revision	Description of Change	Date
Deb Stahler	RCRA 01	Substitute MEDEP/RCRA in the place of MEDEP/DR, and Division of Oil and Hazardous Materials in the place of Division of Remediation. Section 2.0 Introduction: Change first sentence to "MEDEP/RCRA is responsible for the investigation and subsequent corrective actions for RCRA facilities throughout Maine." Add section 5.3.4 Preservation: Preserve all samples according to guidelines in SAMPLING CRITERIA FOR METALS AND ORGANIC COMPOUNDS.	5/31/02

Approved by:

Scott Whittier, RCRA Program Director Date:

SOIL SAMPLING PROTOCOL

Maine Department of Environmental Protection
Division of Site Remediation

Standard Operating Procedure: **DR#006**
REVISION: **#5**
DATE: **January 25, 1999**
Written/Revised by: Brian Beneski
Reviewed by: Jean Firth

1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Site Remediation (MEDEP/DR) procedure for collecting soil samples at or near hazardous substance sites.

2.0 Introduction

MEDEP/DR is responsible for the investigation and remediation of hazardous substance sites throughout Maine. In the course of the investigation and subsequent remediation, samples must be taken to determine the geographical extent, chemical characteristics, and relative levels of contamination at each site and the surrounding area. This standard operating procedure (SOP) is designed to provide guidelines for the collection of soil samples from soil borings, test-pits, trenches, and both surface and shallow subsurface soils.

3.0 RESPONSIBILITIES

All Uncontrolled Sites Program Staff must follow these procedures when performing field activities involving the collection of soil samples. All Managers and Supervisors are responsible for ensuring that their staff are familiar with and adhere to these procedures.

4.0 DEFINITIONS

-- Soil Auger - Stainless steel in construction and consists of a t-handle, extension piece, and a screw-like cutting blade. Used to collect soil samples from various depths. Soil conditions permitting a depth of up to 10 feet can be adequately sampled using a hand auger. Power augers allow for even further depths to be sampled.
-- Remote Sampler - Consists of an adjustable clamp affixed to a telescopic pole made of aluminum or PVC. Sample containers are then attached, and a sample can be obtained from a safe distance (i.e., from the surface level) of an excavation.

-- Grab Sample - A single portion of material from a point source sample location.
-- Composite Sample - Two or more portions of material mixed together to yield a single sample for analysis.
-- Trench - a narrow excavation (at least four feet in depth according to OSHA standards) made below the surface of the ground in which the depth is greater than the width--the width not exceeding 15 feet.
-- Excavation - is any man-made cut, cavity, trench, test pit or depression in the earth's surface formed by earth removal.

5.0 GUIDELINES/PROCEDURES

5.1 Preparation

For initial site visits to unknown situations collect and research any and all background information available. This can include but is not limited to a review of the following:
-- Agency Files (spill reports, permits)
-- Municipal Files
-- Aerial Photos
-- Surficial Geology Maps
-- Well Logs
-- Interviews with Interested Parties & Residents

A sampling and analysis plan should then be developed for the sampling activity. Requirements for a SAP can be found in MEDEP/DR SOP DR#014 - Development of a Sampling and Analysis Plan. In addition to preparing the sampling plan, the sampler must also contact and secure laboratory services.

Develop a sample collection program that starts in areas of lower concentrations or background and progresses to areas of increasing levels of contamination.

5.2 Equipment

Depending on the objectives of the sampling event and site characteristics, there is a great range of equipment available for sample collection purposes. The proper equipment will facilitate a successful and productive field trip. A simple shovel/scoop or specialized equipment such as an auger or thin-walled sampler may be required. If size warrants, large earth moving heavy equipment/ machinery such as back-hoes or bull-dozers may be contracted to perform needed excavations. Dedicate equipment to a specific

sampling location when possible to reduce the potential for cross contamination and the need to field decontaminate between sampling locations.

Below is a list of tools and equipment available to MEDEP/DR staff for sampling and associated tasks.
-- Shovels
-- trowels
-- Lab spatulas, scoops
-- Soil Augers - bucket, screw and push
-- Geoprobe® soil borer

Actual use of shovels, trowels, and augers are for the most part intuitive. For use of the Geoprobe® soil borer, please refer to MEDEP/DR SOP DR#006.

The sampling equipment's composition may vary with analytical needs. For instance, stainless steel is preferred for organic analysis whereas Teflon and/or plastics are preferred for inorganics.

5.3 SAMPLING

Upon arrival at the work area, note conditions around the sample site. If sampling pre-determined locations stated in the SAP, reconnoiter each location to determine whether in fact the sample location is appropriate to meet the goals of the activity stated in the SAP, if this has not been done previously. If sampling based on field conditions, conduct a walkover of the entire area in question and observe the conditions of the site. Look for visual indicators such as stained soil and stressed vegetation resulting from some occurrence other than natural conditions. For instance, pooling liquids are a quick indication of a low area where liquid contaminants are likely to have concentrated. Note the general condition of the landscape (i.e., has it been disturbed or does it appear to be in a natural condition). Designate site boundaries and work zones and establish a secure perimeter to keep out unauthorized persons.

An attempt should be made to keep the samples collected as similar with each other as possible. Choose sample locations that have same soil type and depth if such locations are available and still allow collection of the data that is consistent with the goals of the SAP.

5.3.1 Surface Soil Samples

Use a Scoop, Spatula, Trowel, or other appropriate tool to collect loosely packed shallow (0"-6" in depth) samples. For those soils more densely packed or at greater depths a shovel or an auger can be used.

Begin by removing smeared materials, debris, twigs, rocks and vegetation from the sample point surface to gain a representative sample material. Sample collection can now be performed.

Whenever possible, using the appropriate tools, with hands protected by appropriate gloves, collect and transfer grab sample materials directly into the sample containers. This is especially important for the collection of VOC soil samples. In general, VOC soil samples should not be composited in the field. Add sample material directly into the container, fill it to the level prescribed by the lab, cap the container, wipe or decontaminate as necessary. After capping the sample container, appropriately document all pertinent information (see MEDEP/DR SOP DR#012 - Chain of Custody Protocol, and DR#013 - Field Note Documentation and Development of a Sampling Event Trip Report)and place the sample container into a designated storage container (generally a cooler).

Samplers should properly remove gloves after each surface or subsurface sampling event and dispose of them appropriately. New, clean gloves and sampling devices must be used for each subsequent sampling event. Equipment should be decontaminated as outlined in MEDEP/DR SOP DR#017 - Decontamination Procedures. Upon completion of the sampling event, store the used sampling device in sealed plastic bag(s) until decontamination procedures can be conducted. In the event that the device can not be practically decontaminated, store it until such time that proper disposal can be arranged. For proper decontamination procedures refer to the MEDEP/DR SOP DR#017: Decontamination of Equipment.

If resampling is expected, mark the sample location by placing a marker in the hole such as a stake with flagging. After completing sampling activities, close (fill in) the excavation to ground level to reduce the chance of a tripping hazard, being sure to mark the site for future reference, location with Global Positioning or surveying, or possible confirmatory sampling.

5.3.1.1 Composite Samples

The same procedure described in 5.3.1 is used for the collection of composite samples with the exception of transferring the sample material directly into the appropriate sample container from the sample source. When collecting composite samples, the material is first placed into another container, generally larger in size than the final sample container (for example, a clean pan or bucket) and mixed with other sample materials to form a composite sample. The SAP will outline any specific composite requirements. This mixed sample material is then transferred into the final sample containers in a manner identical to that previously described.

5.3.2 Soil Sampling in Test Pits and Trenches

For samples requiring the use of heavy equipment (i.e. back-hoe, loader) to excavate, samplers should not enter the pit/trench. All observations and samples can generally be taken from the excavation from the ground surface. "Trenching and excavation work presents serious risks to all workers involved. Strict compliance, however, with all sections of the standard will prevent or greatly reduce the risk of cave-ins as well as other excavation-related accidents."(OSHA Subpart P-Excavation, Trenching, and Shoring-1926.650 et seq.). Use a remote sampling device to collect samples at the desired depth from the sidewall or bottom of the pit. The face of the pit/trench should first be scraped (using a long handled shovel or hoe) to remove the smeared zone that has contacted the backhoe bucket. The sample can then be collected directly into the sample jar, by using the remote sampling device and scraping the jar edge across the excavation face. The sample jar can then be capped, removed from the assembly, and packaged for shipment.

Samples can often be obtained directly from the backhoe bucket. Direct the backhoe operator to excavate soil materials from the selected depth or location within the test pit/trench. If VOC's are suspected, monitor the excavated soil with appropriate equipment such as a photoionization detector (PID) or a flame ionization detector (FID). If granular or loose soils and/or uniform materials are encountered, the sample can be obtained directly from the bucket. Collect the sample from the center of the bucket and place it in the sample containers using a trowel or spatula/scoop.

5.3.2.1 Composite Soil Sampling From a Trench or Test Pit

If a composite sample is desired, several depths or locations within the pit/trench are selected and a bucket is filled from each area. Material from each bucket is then placed into an appropriate container where the material is mixed. A sample is then collected using proper tools and containers.

5.3.3 Soil Sampling Below Grade with a Geoprobe

The Geoprobe® Large Bore Soil Sampler can collect soil samples at various depths below grade. Please refer to MEDEP/DR SOP DR#007 - Soil Sampling With A Geoprobe® Large Bore Soil Sampler.

6.0 DOCUMENTATION

Records shall be kept in a field notebook in the manner described in the MEDEP/DR SOP DR#013 - Documentation of Field Notebooks.

7.0 HEALTH AND SAFETY

As part of the SAP, a Health and Safety Plan (HASP) must be developed for site work. Additional safety considerations are required for working with heavy equipment. Note the conditions of the sample area, be aware of the potential physical hazards (i.e., trench, open excavation, loose uneven footing). With each of these unique situations take a common sense approach, that will yield a representative sample in the safest manner possible. Establish alternative means of communication other than verbal for situations when hearing is hampered or impaired.

For information on buried utilities that may be impacted by the excavations occurring on site call the DIG SAFE HOTLINE, toll free at 1-800-225-4977. This is required by law!

Samplers must read the HASP and acknowledge that they have read it and understand it.

8.0 REFERENCES

EPA Training Manual SAMPLING FOR HAZARDOUS WASTES, 165.9 sec. 3 part A.1

EPA 1983 PROTOCOLS for SOIL SAMPLING TECHNIQUES and STRATEGIES B.J. Mason, Environmental Monitoring Systems Laboratory, Contract Number CR808529-01-2

EPA 1987 A COMPENDIUM of SUPERFUND OPERATIONS METHODS, 540/P-87/001 OSWER Dir. 9355.014

EPA 1987 DATA QUALITY OBJECTIVES for REMEDIAL RESPONSE ACTIVITIES, 540/G-87/003 OSWER Dir. 9355.078

EPA 8/1/88 WESTON ESAT DIV. SOIL SAMPLING IN TEST PITS and TRENCHES DRAFT

EPA 8/23/89 WESTON ESAT DIV. SOIL and ROCK SAMPLE ACQUISITION

U.S. Department of Labor Occupational Safety and Health Administration 1990(Revised) EXCAVATIONS OSHA 2226

Department of Environmental Protection
Bureau of Remediation & Waste Management
RCRA Program

Standard Operating Procedure Change Record

Title: SOIL SAMPLING WITH THE GEOPROBE® LARGE BORE SOIL SAMPLER

Identification #: DR07

SOP Originator: Brian Beneski

Author	Revision	Description of Change	Date
Deb Stahler	RCRA 01	Substitute MEDEP/RCRA in the place of MEDEP/DR, and Division of Oil and Hazardous Materials in the place of Division of Remediation. Section 2.0 Introduction: Change first sentence to "MEDEP/RCRA is responsible for the investigation and subsequent corrective actions for RCRA facilities throughout Maine."	5/31/02

Approved by:

_____

Scott Whittier, RCRA Program Director Date:

SOIL SAMPLING WITH THE GEOPROBE®
LARGE BORE SOIL SAMPLER

Maine Department of Environmental Protection

Division of Site Remediation

Standard Operating Procedure: **DR#007**
REVISION: **#1**
DATE: **May 10, 1999**
Written/Revised by: Brian Beneski
Reviewed by: Gordon Fuller

1.0 PURPOSE

The purpose of the document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Site Remediation (MEDEP/DR) procedure for obtaining soil samples using Geoprobe®'s Large Bore Soil Sampler (LBS).

2.0 INTRODUCTION

MEDEP/DR is responsible for the investigation and remediation of hazardous substance sites throughout Maine. MEDEP/DR utilizes the LBS as an investigative tool. The LBS is a solid barrel, piston-sealed, direct push device that allows the collection of discrete interval samples of unconsolidated materials at depth. In addition to providing soil samples for chemical analysis, the geological characteristics of the overburden can also be logged.

The MEDEP has two methods for advancing the LBS into the soil:

1) A 30 lb. Manual sliding hammer constructed by Geoprobe®; and
2) "The Little White Wagon" (LWW) hydraulic drive rig, constructed by Concord Environmental.

3.0 RESPONSIBILITIES

All MEDEP/DR staff who utilize the LBS for site work are responsible for following the procedure outlined in this SOP. The field staff in MEDEP/DR and geological support staff in MEDEP Division of Technical Services (MEDEP/TS) are staff specifically responsible for using the LBS at hazardous substances Sites. Additionally, field staff must attend training, demonstrate, and maintain proficiency in the use of the LWW.

Other MEDEP/DR staff may perform tasks with the LBS after receiving sufficient training in the use of the LBS, or if accompanied by a MEDEP/DR or /TS field staff member when utilizing the manual hammer for drive. Non field staff are

not allowed to use the LWW unsupervised unless adequately trained, and have demonstrated proficiency in the use of the LWW prior to the field activities.

4.0 EQUIPMENT

A list of equipment necessary for the operation of the LBS can be found in Section 3.0 of Attachment A - Geoprobe Large Bore Soil Sampler SOP. Additional equipment not mentioned in Attachment A includes:

-- Drive mechanism - LWW or Manual Hammer
-- Sample collection equipment - See MEDEP/DR SOP DR#006 - Soil Sampling
-- Decontamination Supplies - See MEDEP/DR SOP DR#017 - Decontamination Procedures

5.0 PREPARATION

Prior to conducting any sampling event, a Sampling and Analysis Plan (SAP) must be developed according to the procedures outlined in MEDEP/DR SOP DR#014 - Development of a Sampling and Analysis Plan.

6.0 OPERATION

There are two distinct operations when using the LBS for soil boring; the “drive” operation, in which the LBS is actually driven into the ground, and the use of the LBS itself. Assembly and operation of the LBS can be seen in Attachment A - Geoprobe® Large Bore Soil Sampler Standard Operating Procedure; Technical Bulletin No. 93-660.

There are two methods available for driving the LBS, the LWW and the manual slide hammer. Operation of the LWW can be seen in Attachment B - Concord Environmental Equipment Little White Wagon Operator’s Manual.

Operation of the manual slide hammer is intuitive.

After using the LBS (and appropriate drive), soil samples should be collected using the procedures outlined in MEDEP/DR SOP DR#006 - Soil Sampling, and chain of custody procedures outlined in SOP DR#012 - Chain of Custody Protocol.

7.0 DOCUMENTATION

Field notes should be recorded as described in MEDEP/DR SOP DR#013 - Documentation of Field Notes and Development of a Sampling Event Trip Report.

8.0 DECONTAMINATION

All equipment should be decontaminated as outlined in MEDEP/DR SOP DR#017 - Decontamination Procedures.

State of Maine Department of Environmental Protection		**Boring No.:**
Project Name:		Page of
Weather:	Date Started:	Date Completed:
Equipment:	Casing Size:	Total Depth:
Ground Elevation:	Operator:	Water Level:
Logged By:	OVM/TIP/HNU:	Field Analysis Method:

Sample #	Depth in Feet bgs	Lab Analysis	Field Analysis	PEN ----- REC	Headspace (ppm)	Soil Description	Notes/Observations	

Soil Classification System: ASTM D-2488-84

Name	Size Limit	Sieve Size Pass	Sieve Size Ret.	Example
Coarse Sand	2mm-4.75mm	#4	#10	Rocksalt
Medium Sand	0.42mm-2mm	#10	#40	Sugar/Salt
Fine Sand	0.075-0.42mm	#40	#200	Powder Sugar
(silts/clays)	<0.075	#200		

Name	Size Limit	Sieve Size Pass	Sieve Size Ret.	Example
Boulder	12" OR MORE	---	---	Basketball
Cobbles	3-12"		3"	Grapefruit
Coarse Gravel	3/4"-3"	3"	3/4"	Orange/Lemon
Fine Gravel	4.75mm-3/4"	3/4"	#4	Grape or Pea

Terms of minor components	
and	35-50%
some	20-35%
little	10-20%
trace	1-10%

Standard Operating Procedure

Collection and Handling of Soil Samples for Analysis for Gasoline Range Organics

1.0 Summary

This SOP provides a method for sampling and preserving soils by staff of the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, for analysis for gasoline range organics (GRO). It may also be applicable when sampling for analysis for other volatile organic compounds.

2.0 Purpose

The details provided in this method are intended to reduce losses of GRO during sampling, storage and transport. These include:

- collection by coring to minimize sample disruption,
- preservation by slurrying the sample with methanol (or optionally by maintaining the sample(s) at dry ice temperature) to deter biodegradation and
- isolation by cleaning the cap and vial threads to facilitate tight closure and reduce volatilization, and by using polytetrafluoroethylene(PTFE)-lined lids.

3.0 Scope and Applicability

The techniques described in this SOP are intended for use for GRO in soils. They are mandatory for sampling soils for GRO analysis using any method adopted by the Maine Department of Human Services as applicable for certified analysis. The techniques may be applicable under certain conditions of field sampling for low level and mid level GC/MS analysis, and field screening for GRO in soils.

Managers or supervisors are responsible for ensuring that the staff they supervise are familiar with and adhere to this SOP when performing or procuring soil sampling for GRO analysis.

4.0 Detailed Description of the Method

4.1 Preservative

Samplers shall use methanol (**or** dry ice) to preserve soil samples. The methanol must be appropriate for the purge and trap method of analysis. It is necessary that the methanol be subjected to quality control analysis before use. The target ratio of sample to methanol shall be one-to-one by volume. Results from any sample not preserved by methanol **or** dry ice are, and must be reported as, minimum values. Waste liquid methanol and methanol-preserved samples not submitted for laboratory analysis must be managed as hazardous waste.

4.2 Containers

Samplers shall use clean, quality-controlled, glass containers with PTFE-lined lids. The recommended container volume is 60 mL. The mouth must be wide enough to allow insertion of the coring syringe without contacting the container. It is preferable that the containers be pre-weighed, with the weight recorded on the labels. Containers not pre-weighed must be tared after analysis. The sample plus methanol volume shall not be less than one-tenth of the container volume. When using dry ice as a preservative, take care to minimize headspace.

4.3 Sampling devices (coring syringes)

4.3.1 Use disposable open-barrel (without Luer-tip end) plastic syringes for sampling. Store in clean polyethylene zipper closure bag, or other suitable clean container. Twenty milliliter (20 mL) syringes are recommended for most applications, especially for coarse soils. Ten milliliter (10 mL) syringes are acceptable. Use a clean coring syringe for each sample collected for GRO analysis. Syringes having rubber or other elastomer seals are not acceptable.

4.3.2 Alternatively, reuseable coring devices may be used in lieu of disposable plastic syringes (e.g. stainless steel, PTFE, brass, etc.). The chosen sampling device must be decontaminated before each use.

4.4 Sampling Procedure

4.4.1 Collect samples for GRO analysis as soon as the soil has been exposed to the atmosphere. Respond to any delay by preparing a fresh sampling surface and starting over.

4.4.2 Examples of sample types collected during a sampling event are those from split spoons, Geoprobes®, bucket augers, test pit walls (naturally exposed soil horizons), backhoe buckets or surface grid locations. Expose the sample site (i.e., open the split spoon, scrape the pit wall surface, remove vegetation and top soil from a surface grid location, etc.) and quickly collect the soil sample.

4.4.3 Samplers shall use appropriate personal protective equipment (PPE) for the specific sampling event, including eye protection and methanol-compatible gloves. To prevent cross contamination, samplers shall wear clean gloves for each sample collected.

4.4.4 At each sampling location, prepare a sample for GRO analysis by transferring a soil plug **less than one-half the container volume** to the sample container using a coring syringe. Collect a co-located sample for dry weight determination of the associated GRO sample, if required by your laboratory.

4.4.5 Before coring the exposed soil, retract the plunger of the coring syringe leaving barrel space for the desired soil sample volume. The recommended volume is 10 mL.

4.4.6 Insert the coring syringe into the soil surface far enough to fill the preset barrel space. If the soil medium being sampled does not have adequate depth, or if stones prevent the collection of the total amount desired in a single insertion, repeat the motion until the coring syringe contains the desired volume.

4.4.7 It is recommended that methanol be added to the pre-weighed container before the soil is cored and added. Insert the coring syringe into the mouth of the pre-weighed container and expel the soil plug into the container by pushing the plunger of the syringe. After expelling the soil plug, ensure that the threads and sealing surface of the container are clean. Cap the container securely. (It is not recommended that methanol be added to the sample container after the soil plug because of the possibility of increased volatile loss.)

4.4.8 Completely disperse samples in methanol by shaking to produce a slurry. Transport cohesive clay soils that do not disperse well in the field to the laboratory as soon as possible**,** and instruct the laboratory to disperse the sample by appropriate means immediately upon receipt. Note the need for dispersal on the Chain-of-Custody form.

4.4.9 For the dry ice preservative option, collect and handle the sample(s) as described above with the exception of the addition of methanol. Place sample(s) on dry ice immediately after collection. Maintain samples at dry ice temperature until dispersed in methanol by the laboratory. (Note: Dry ice requires special handling. Do not use without appropriate training and equipment.)

4.5 Sample Storage

To prevent cross contamination, separate all methanol-preserved soil samples from all other samples in a clean shipping/storage container. Clean the outside of each sample container before placing in the shipping/storage container. Neat materials should not be placed in any container used for the transport or storage of environmental samples.

4.6 Sample Holding Times

Maximum holding time for GRO samples is 14 days. Transport samples to the laboratory expeditiously.

4.7 Chain of Custody

Maintain Chain-of-Custody procedures for each sampling event.

5.0 Quality Assurance

5.1 Document all deviations from the procedures described in this SOP, and all choices of elective alternatives, in the field notebook and any subsequent report.

5.2 Compositing of soil samples for GRO analysis is not acceptable.

5.3 Handle and store field QA samples (i.e., trip and field blanks, co-located samples) in the same manner as environmental soil samples.

5.4 Collect background samples when high levels of naturally occurring organic compounds are suspected (e.g., peat and septage).

5.5 Take additional co-located samples for replicate GRO analysis when necessary. The recommended minimum sampling frequency for co-located samples is one for every ten environmental samples collected; at least one per sampling event. Meaningful co-located samples can only be obtained from undisturbed soil horizons.

5.6 Collection and analysis of the following QA samples is **mandatory**:

5.6.1 Prepare one methanol trip blank per field batch when using pre-preserved sample containers. (Not required when dry ice preservation is used.) Each sample storage and shipping container should contain a trip blank. Trip blanks are not required when adding methanol in the field.

5.6.2 Prepare at least one field blank per day per sampling event. If the methanol is added before mobilization, open the container in the field as if adding a sample. If the methanol is added in the field, add it in the same environment and in the same manner as though a sample were being preserved. Take additional field blanks at sample locations where air-borne contamination is specifically suspected. Identify the samples that are associated with each field blank.

5.7 GRO results must be expressed on a dry weight basis, using the laboratory-determined sample dry weight, or when necessary, using the associated co-located sample dry weight. Evaporation of the analyzed sample to dryness is preferred over co-located sample use.

5.8 Request laboratory analysis and results of all QA samples.

5.9 All analytical data for QA samples and environmental samples reported by the laboratory, must appear together in any subsequent report.

Definitions:

A sampling event is a single cycle of mobilization and sample collection, at a single physical site, carried out by a single team of personnel.

Co-located samples are second samples collected as near to and as close in time to first samples as feasible. They are not true replicate soil samples for volatile analytes, because it is not feasible to demonstrate homogeneity of the matrix. A co-located sample represents the best attainable approximation of such a replicate, for the given location and matrix.

Field blanks, for the purposes of this SOP, are samples of methanol from the same source as that used for sample preservation. They are exposed to the atmosphere at the sampling site to serve as a check on air-borne contamination. They are required because methanol is an avid solvent for gasoline range organics.

Trip blanks are sample containers containing methanol from the same source as that used for sample preservation**.** They are preferably prepared by the laboratory**,** alternatively by field personnel in the clean area where the methanol and sample containers are stored, before leaving for the field. Their purpose is to detect contamination of samples associated with transportation and handling and as a check for any contamination in the containers or methanol as received from the supplier.

A field batch of samples (as distinct from a laboratory batch of samples) is a group of samples collected during one sampling event, and stored and transported in a single shipping container, regardless of the number of samples in the group.

OSJSOP/sjm

Department of Environmental Protection
Bureau of Remediation & Waste Management
RCRA Program

Standard Operating Procedure Change Record

Title: **MICROWELL INSTALLATION PROTOCOL**

Identification #: DR09

SOP Originator: Brian Beneski

Author	Revision	Description of Change	Date
Deb Stahler	RCRA 01	Substitute MEDEP/RCRA in the place of MEDEP/DR, and Division of Oil and Hazardous Materials in the place of Division of Remediation. Section 2.0 Introduction: Change first sentence to "MEDEP/RCRA is responsible for the investigation and subsequent corrective actions for RCRA facilities throughout Maine."	5/31/02

Approved by:

_____

Scott Whittier, RCRA Program Director Date:

MICROWELL INSTALLATION PROTOCOL

Maine Department of Environmental Protection
Division of Remediation

Standard Operating Procedure: **DR#009**
REVISION: **#1**
DATE: **January 22, 1999**
Written/Revised by: Brian Beneski
Reviewed by: Troy Smith

1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Remediation's (MEDEP/DR) procedure for installation of microwells.

2.0 INTRODUCTION

MEDEP/DR is responsible for the investigation and remediation of uncontrolled hazardous substance sites throughout Maine. In the course of the investigation, MEDEP staff may install microwells for the collection of samples of groundwater from the overburden. This standard operating procedure (SOP) is designed to be a guideline for installation of overburden microwells.

Microwells provide an inexpensive, yet effective method for obtaining overburden groundwater samples. Microwells can be installed for collection of groundwater samples on a temporary basis, or placed in secured, out of the way locations, can be effective as long term monitoring points.

3.0 RESPONSIBLITIES

All MEDEP/DR staff who perform field activities are responsible for following the procedure outlined in this SOP for the installation of microwells in this SOP. The field staff and geological support staff, (as part of the MEDEP Division of Technical Services (MEDEP/TS)) are generally responsible for installation of microwells. Their respective supervisors and managers are responsible for ensuring that they are familiar with and adhere to this procedure, and receive the appropriate training and guidance for conducting this procedure. Other MEDEP/DR staff will receive training for this procedure on an as needed basis.

4.0 DEFINITIONS

- Geoprobe® - A method of obtaining soil borings utilizing Geoprobe Systems direct push technology. A description

of operation of the Geoprobe Large Bore Soil Sampler can be seen in SOP DR#007.

- Borehole – The hole created in the ground after using the Large Bore Soil Sampler for collecting soil borings, or the Large Bore Pre – Probe designed specifically for creating a hole for installation of a Microwell, or for continued soil sampling at depth.
- Annulus – Space in the borehole between Microwell screen or casing and the borehole wall.
- Riser – Threaded 3/4 inch ID pipe constructed of polyvinyl chloride plastic, available in various lengths.
- Slotted Screen – Threaded, 3/4 inch ID PVC casing constructed with 0.010 slots to allow water to enter the microwell from the surrounding formation.
- Filter sand - Clean, well rounded screened sand that is placed in the annulus between the borehole wall and the well screen to keep formation material from entering the completed microwell.
- Granular bentonite - a hydrous aluminum silicate available in powder, chip, granular, or pellet form, that is used to provide a tight seal between the borehole wall and the well casing.

5.0 EQUIPMENT

Equipment required for installation of microwell include:

- Geoprobe® Systems Large bore system with either a manual hammer or Concord Environmental Systems "Little White Wagon" hydraulic direct push rig;
- ¾ inch PVC Riser;
- ¾ inch PVC 0.010 inch slotted screen;
- ¾ inch PVC threaded end caps;
- Geoprobe® 1.1 inch OD expendable point;
- filter sand; and
- Granular bentonite.

6.0 MICROWELL INSTALLATION PROCEDURE

1) Using the Geoprobe® Large Bore System or the Pre - Probe, and the chosen driving mechanism (manual hammer or White Wagon rig), construct a bore hole to the depth desired for the microwell. See SOP DR#007 – Soil

Boring with a Geoprobe® Large Bore Soil Sampler. In microwells over 15 feet deep, it is sometimes prudent to bore one or two feet deeper than desired. After reaching the depth desired, leave soil borer or probe in borehole (to prevent premature borehole collapse), and proceed to Step 2.

2) Construct the microwell using the PVC riser, slotted screen, and end cap or disposal tip. Length of Screen and Riser will vary, depending on the formation to be sampled and depth of the individual well. For shallow wells (less than 15 feet), a blunt end cap will usually suffice. In deeper wells or easily collapsible formations, construct a "modified screen" by sawing off the threads to the riser with a hacksaw (approximately one inch off of the tip), and hammer a Geoprobe Expendable Point into the end of the riser by banging the riser and tip on a truck tailgate or other sturdy object. Deeper wells may also require the construction of the well in sections while installing the well in the borehole; use best field judgement to determine the technique.

3) Remove the soil Borer or pre - probe from the borehole, and install the microwell immediately after withdrawal. If the well does not finish into the borehole to the required depth, utilize the manual hammer to provide extra force in pushing the well into the borehole (be careful not to apply enough force to crush the slotted screen).

4) If the well still does not advance to the appropriate depth, remove the well, and re - drill the borehole with the soil borer or blunt probe. It is sometimes helpful to clean out collapsed material from the borehole by "resampling" with the soil borer several times. Reinstall the microwell when re – drilling is completed.

5) Carefully pour filter sand into the annulus around the casing to ensure that the well screen is surrounded by the filter sand. The level of filter sand should rise above the top of the screen by a minimum of 1 foot.

6) Place granular bentonite into the annulus to approximately the ground surface.

Once the microwell has been installed, it should be properly surveyed in (if to be used for water level information), capped with an appropriate end cap, and permanently marked with the correct well designation. The appropriate security measure (such as a road box, or locking outer casing), if required, can then be installed over the microwell. The well should then be developed after allowed to sit for at least one week.

6.1 Well Installation Evaluation

If the microwell does not install into the borehole after repeated attempts to clean out collapsed material, the particular formation may not allow for installion of a microwell with this method. In situations as this, use of the Geoprobe Slotted Mill Slotted Well Point(See SOP DR#015) for temporary groundwater sampling points may be a appropriate, as well as installation of a full size monitoring well with a rotary drilling rig.

7.0 MICROWELL DEVELOPMENT

Development is necessary in order to remove fines from the vicinity of the well screen and silt that has accumulated in the well that has been disturbed and settled during the course of installation of the microwell. Development is also necessary to develop the filter sand in the annulus around the well. Fine particles are drawn into the pore spaces of the sand pack to block other fine material from entering. Microwells can be developed by overpumping, or a combination of surging and overpumping. Microwell development is a skill which is developed over time, as each well is unique in its development requirements.

7.1 Development Procedure

Using a peristaltic pump and ¼ inch polyethylene tubing, pump the wells while agitating the well with the tubing to stir up fines silt and silt, and allow this material to flow out with the purged water. Allow the tubing to reach the bottom of the well to remove as much settled material as possible. It may be necessary to completely evacuate the well several times in order to fully removal all of the fines and settled material.

If water from the microwell is still turbid, it may be necessary to surge the well with a surge block type device in order to remove sediment (A device which works very well for this is a screw together chimney sweep rod extension). After surging the well with the device to flush water in and out of the well through the slot and the sand pack, continue with pumping the well as described above until the water is generally silt free.

While developing the well, records regarding flow rates and recharge rates should be kept in order to fully evaluate the well and the formation in which it is screened. This information will also be used in developing purge rates for future sampling.

The well should then have ¼ inch tubing dedicated to the well. The ideal location for the tubing intake is directly in the middle of the screen. However, if the screen is not fully saturated (not ideal, but acceptable), then the intake should be placed halfway between the lowest expected water level and the bottom of the screen.

After development, the microwell should be allowed to sit for at least two weeks prior to sampling. Microwells are most appropriately sampling using Low Flow Sampling methodology; please refer to SOP DR#003 for a discussion on this sampling technique.

8.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance activities which apply to the implementation of this procedure. However, all field work should be conducted following “standard field procedures” for field documentation, sampling, decontamination, and safety and health issues, as described in the specific MEDEP/DR SOP.

PROTOCOL FOR COLLECTING AND ANALYZING MERCURY VAPOR IN AIR WITH A LUMEX RA-915+ MERCURY ANALYZER

Maine Department of Environmental Protection
Bureau of Remediation and Waste Management

Standard Operating Procedure: **BRWMHg01**
Revision: **1**
Effective Date: **February 1, 2003**
Revision Date: **January 15, 2003**
Written by: **Deb Stahler**
Reviewed by: **Mary Corr**

Approval:

Malcolm Burson, MDEP Quality Assurance Manager date

David Lennett, Bureau Director date

1.0 APPLICABILITY

This standard operating procedure (SOP) is designed to be a guideline for operating the Lumex RA-915 for mercury vapor analysis. The Lumex RA-915 is applicable for ambient air testing of mercury vapor in the range of 20 ng/M^3 to 50,000 ng/M^3. (50,000ng/M^3 = .05mg/M^3, the PEL for mercury) For areas of higher concentration, a Jerome meter should be used. Do not directly expose the RA-915 to elemental mercury as this may permanently contaminate the instrument.

The ambient air guideline for mercury is 300 ng/M^3.

2.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management [MDEP/BRWM] procedure for collecting and analyzing air samples for mercury vapor analysis.

3.0 RESPONSIBILITIES

All Bureau Staff must follow this procedure when using the Lumex RA-915 for mercury vapor analysis. All managers and supervisors within MDEP/BRWM are responsible for ensuring that their staff is familiar with and adhere to this procedure. This instrument is not intrinsically safe and must not be used in confined spaces without proper training, monitoring, and permits required in the Department's Confined Space Policy. Any mercury reading above 300 ng/ M^3 [the ambient air guideline] will require pregnant or potentially pregnant staff to leave the area or use appropriate respiratory protection. MDEP/BRWM staff should not work for extended periods of time [over 30 minutes] where mercury reading are above 12,500 ng/M^3 (1/2 of the ACGIH TLV of 25,000 ng/M^3) without appropriate respiratory protection. Mercury reading above 25,000 ng/M^3 (1/2 of the OSHA PEL) require MDEP/BRWM staff to leave the area or use appropriate respiratory protection. Any exposures over 25,000 ng/M^3 should be reported on a safety exposure report form.

4.0 DEFINITIONS:

4.1 MDEP: Maine Department of Environmental Protection
4.2 BRWM: Bureau of Remediation and Waste Management
4.3 Hg: Mercury
4.4 SOP: Standard Operating Procedure
4.5 OSHA: Occupational Safety and Health Administration
4.6 PEL: Permissible Exposure Limit

5.0 PROCEDURES

5.1 Starting the instrument:

- The instrument can be powered by either 120-v AC line current [with adapter cord], a battery pack in the instrument, or vehicle cigarette lighter adapter. The battery pack is intended for a maximum of 4 hours continuous use, and should be recharged using the included cord plugged into120 v AC line current. The instrument may be used with batteries if the battery indicator is flashing red. A

steady red indicates the battery needs to be charged and AC power must be used to run the instrument. A supplemental battery pack is stored in the side pocket and can be plugged into the AC adapter cord port. The supplemental battery will provide an additional 2 hours use.

- Pre-operational procedures:
  1. Before operating the RA-915, conduct a visual inspection of the analyzer's component parts. The instrument may be used while in the carrying case.
  2. Place the RA-915 in a horizontal position with the Palm monitor (controls and display screen) on top. The power switch will be the front end. (see photo 1)
  3. Set the test cell control handle (on the side of instrument) to the **OFF** position. This can be accessed inside the side pocket of the carrying case.
  4. Check to make sure Palm monitor is securely connected to the base unit.
  5. The handle for optical bridge switch at the back and opposite the power switch should be pre-set to position III.
- Turn on the power switch on front of the instrument. The Palm monitor will then show the Lumex version screen (see photo 2).
- Press the "Ent" button on the Palm monitor. The MAIN MENU display will appear. There will be an * next to the words MAIN MENU.
- Press [3-5 sec] and release the Lamp Ignition button on front of the machine. When the lamp lights the * next to the words MAIN MENU will disappear. Repeat this step as necessary to light the lamp.
- Allow the instrument to warm up for 5 minutes prior to testing.

5.2 Menu Screens:

The MAIN MENU will have the following options:

- Parameter ⇒ Used to change parameter settings (see below).
- On Stream ⇒ Used to analyze background and environmental samples.
- On Time ⇒ Not used for air analysis.
- Test ⇒ Used to verify instrument calibration.
- Settings ⇒ Used to save new parameter settings or restore factory settings. This should not normally be used.

To select an option, highlight the option and push the ***Ent*** button.
To return to the main menu, push the ***Esc*** button.

Parameter settings for air analysis should generally follow preset values. The following settings have been stored:

Parameter	Value	Units
Average time	1	sec
Baseline Cor time	20	sec
Frame time	10	sec
Integr. time	120	sec
Low limit	20	ng/M^3
High limit	300	ng/M^3

5.3 Background air analysis:

- Prior to taking the instrument to a potentially contaminated site, a background air sample should be analyzed to demonstrate that the instrument reading is below the reporting limit for this instrument, 20 ng/M^3.

- A background sample must be taken at the beginning and end of each analysis day. All results must be below 20 ng/M^3. Do not proceed until this condition has been met.
- For this analysis the Lumex RA-915 should be operated in the ON STREAM mode as described below:

Operation in ON STREAM (AIR ANALYSIS) mode

1. The optical bridge handle should already be in the OFF position as described in the starting instructions above [section 4.1].
2. Use the arrow buttons, on the Palm monitor indication unit to select the ON STREAM mode and press the Ent button. This will switch the compressor on, and the zero signal will be measured. The following will occur on the display (see photo 3):
   - The current S value which corresponds to the mercury concentration in the pumped air in ng/M^3 is displayed in the upper right of the palm monitor
   - The Si level is also displ ayed below the S value. This result [Si] corresponds to the value S averaged over a given time range.
   - The bottom right displays a countdown [in seconds] of the time over which S values were averaged. The current setting is for values to be averaged over 10 seconds.
   - An **Alarm!!** Message is displayed across the top of the screen if the mercury concentration exceeds the ambient air guideline. Any mercury reading above the ambient air guideline [300 ng/ M^3] will require pregnant or potentially pregnant staff to leave the area or use appropriate respiratory protection.
3. If the ***Ent*** button is pressed a second time, the following changes occur on the display
   - Three Si readings and S_c [the average of these three Si readings] are displayed. In this mode three 10 second average readings are repeated, averaged, and displayed with the corresponding relative deviation [R] in the measurements.
   - The average, S_c = (S1+S2+S3)/3.
   - The relative deviation of three measured concentrations is displayed as R
     R = 100*(max(S1,S2,S3) - min(S1,S2,S3))/S_{ave}, %.
   - If S_c is less than the parameter "Low limit" (20 ng/M^3), "< 20" is displayed.
4. Record the three Si readings, S_c and R for the background sample in a field notebook and any analysis record developed for the current sampling event.
5. If the background reading does not fall below 20 ng/M^3, remove the intake hose and repeat the procedure to determine whether the intake hose is contaminated.
6. To quit the On Stream mode, press the ***ESC*** button, which causes the air pump to switch off. The device switches over to the standby mode waiting for the next command. The message MAIN MENU appears on the Palm display.

5.4 Calibration verification:

- The instrument calibration must be verified on each analysis day prior to analyzing samples, and again at the end of the day.
- The calibration is considered verified if the relative deviation [designated with R on the instrument] is below 20%.
- Calibration verification is measured in the TEST mode as described below:

Operation in the TEST mode (serviceability check)

1. Use arrow buttons, on the indication unit to select the (TEST) mode and press the ***Ent*** button. After the instrument measures the zero signal the display will show the message *Enter Test Cell*.

2. Set the test cell handle on the side of the instrument to the ON position, and wait for 20 seconds before pressing the ***Ent*** button. The following will be displayed:
   - The current S value which represents the measured mercury concentration in the test cell in ng/M^3;
   - the Sk value, which represents the mercury concentration which should be measured based on the test cell temperature; (see table on page 21 of the RA-915+ Operation Manual for reference)
   - the average measured mercury concentration [Si];
   - the relative deviation [R] of the measured value average [Si] from the theoretical value is automatically calculated by: R= 100*|(Si- Sk)/Sk|; and
   - a countdown [in seconds] of the time over which Si values were averaged. The current setting is for values to be averaged over 10 seconds.
   - The message "*Temperature*" is displayed across the top, if the temperature of the test cell is beyond the admissible temperature range for proper operation of the analyzer.
3. Record the Si, Sk, and R values associated with the calibration check in a field notebook and any analysis record developed for the current sampling event.
4. If the relative deviation [R] of the measured values Si from its table value is below 20%, the RA-915+ analyzer is ready for operating, otherwise see "Maintenance" in the Operation Manual.
5. To quit the TEST mode, press the ESC button whereupon the analyzer switches over to the standby mode for the removal of the test cell. The display will show the message Remove Test Cell. Remove test cells and press the ESC button again and the analyzer switches over to the standby mode waiting for the next command. The message appearing on the display reads MAIN MENU.

5.5 Analysis:

- Allow the Lumex RA-915 to equilibrate to site temperature.
- Sample locations should be selected according to a site plan designed for the specific site. It is important to note that environments with high levels of mercury are not suitable for the Lumex RA-915. Several precautions should be taken at possibly contaminated sites:
  1. Use a Jerome meter to delineate areas possibly contaminated above 0.05 mg/M^3.
  2. If a Jerome meter is not available, start the investigation outside the possibly contaminated areas and work toward the contaminated areas stopping when the mercury readings exceed the calibration range of the instrument [0.05 mg/M^3].
  3. Do not place the instrument on any potentially contaminated area, including floors or surfaces where mercury has been spilled.
  4. Do not place the inlet sample tube on any potentially contaminated surface.
- Air temperature should also be measured and recorded concurrently with the mercury sample results. A digital thermometer is included in the travel case with the mercury analyzer for this use.
- For this analysis the Lumex RA-915 should be operated in the ON STREAM mode as described in section 4.3, making sure to record the three Si values, Sc, and R in a field notebook and any analysis record developed for the current sampling event.
- Check a [low] background sample and calibration verification at the end of the sampling day.

- To turn the instrument off press the Esc key to go to the main menu. Then turn the power toggle switch off. If the instrument was operated on battery power, the battery must be recharged prior to storing the instrument. Storing the instrument with an uncharged battery may cause damage to the battery.

5.6 Instrument Maintenance and Storage:

- The instrument should be stored in a low mercury [<20 ng/M^3] atmosphere at temperatures between 40^{o}F and 100^{o}F with relative humidity less than 80%. If it is inadvertently stored below 32^{o}F, it should be taken to and kept at a temperature of 60^{o}F or higher for up to 24 hours [temperature dependent] prior to use.
- When the analyzer is used with battery power, the battery must be recharged before returning the instrument to storage. Storage of a discharged battery for 3 days may permanently damage the battery.
- Maintenance procedures for the analyzer include:
  1. daily [when in use] visual inspection;
  2. periodic preventive maintenance;
- All the maintenance operations should be duly recorded in the analyzer log.
- Daily [when in use] inspection is performed in the work place and involves visual inspection of the analyzer and serviceability check. The serviceability check consists of a background air check for contamination and a calibration verification check.
- Periodic prevention maintenance is performed in the work place and involves:
  1. Quarterly:
     - checking the fastening of the body covers;
     - checking the connectors for cleanness;
     - checking the state of the cables;
  2. Checking the dust filter: A small dust filter is located inside the intake hose attachment port. This filter should be checked on a quarterly basis [sooner if used in high dust areas] and replaced if the dust filter has turned color from white to brown & appears to be clogged. To remove the filter for inspection/ replacement, use a pair of tweezers.
  3. The built-in absorption filter (located in the left-hand inlet on the front wall of the base unit) should be replaced as needed. Typically this will be once or twice per year. If the instrument is used often, or in a mercury environment above 10,000ng/M^3 for a period of time the filter should be replaced more often.
- Annual prevention maintenance is recommended. It is performed by OhioLumex and involves recalibration and checking the RA-915+ for conformity to the technical specifications.
- For further information refer to the Operation Manual. *OhioLumex is in the process of updating the recommended maintenance procedures for this instrument. When these updates are completed the maintenance section of this SOP will be modified to reflect any changes.*

5.7 Documentation

All sampling activities must be documented according to a site-specific plan, either in a field notebook or on pre-printed sampling worksheets. At a minimum the following items must be documented:

- Project name
- Date and time of sample
- Background air results
- Calibration verification results
- Sample location
- Name of person[s] performing air sampling/ analysis
- Temperature
- Mercury result
- Any special considerations or sampling conditions

5.8 Quality Assurance/Quality Control

5.8.1 QA Sample Collection: Collection and analysis of the following QA samples is mandatory:

- Background sample: A background air sample should be taken outside of the site and in a location where there is no [low] mercury contamination. Results must be below 20 ng/ M^3. This sample is taken to ensure that the instrument is free of contamination. At a minimum, background samples should be taken at the beginning an end of each sampling day. If the instrument is taken into an environment where mercury vapor concentrations exceed the calibration range of the instrument [50,000 ng/ M^3] a background sample must be re-analyzed before continuing with the sampling event.
- Calibration verification: The instrument calibration must be verified at the beginning and end of each sampling day. The calibration is considered verified if the relative deviation [designated with R on the instrument] is below 20%. The instrument must be returned to the factory for calibration yearly, and when calibration falls outside the designated range.
- Duplicate samples: Each time a sample is analyzed the instrument automatically takes three 10 second average readings [Si] and averages the three readings to arrive at a result [Sc]. A relative deviation [displayed as R] is also calculated by the instrument by the following formula:

  $R = 100*(\max(S1,S2,S3) - \min(S1,S2,S3))/S_{ave}$
  $S_{ave} = (\max(S1,S2,S3) + \min(S1,S2,S3))/2$

5.8.2 Deviations from SOPs: All deviations from the procedures outlined in this or in any other SOP must be documented in field notes.

6.0 REFERENCES:

1. **Multifunctional Mercury Analyzer RA-915+ Operation Manual**, OhioLumex Co, Inc. Analytical Equipment, Cleveland, Ohio, 2001.
2. **Quality Assurance Plan** for Maine Department of Environmental Protection's Division of Site Remediation, Revision 2, April 30, 1999
3. **Standard Operating Procedure Development, Formap, Approval and Distribution,** Maine Department of Environmental Protection SOP OC-PR-0001, 6/15/01.

Mercury in Solids using RP-91C and LUMEX RA-915+ MERCURY ANALYZER

Maine Department of Environmental Protection

Bureau of Remediation and Waste Management

Standard Operating Procedure: Mercury in Solids
SOP Number: BRWM Hg02
REVISION: 1
DATE:
Written/Revised by: Deb Stahler
Reviewed by:

Approval:

Malcolm Burson, MDEP Quality Assurance Manager date

David Lennett, Bureau Director date

1.0 APPLICABILITY:

This SOP is applicable as a field test for mercury in solids. It does not contain a provision for reporting results on a dry weight basis, and therefore should not be used as the sole basis for making key project decisions. A percentage of the samples should be confirmed by fixed laboratory analysis.

For detailed operations of the RA 915 mercury analyzer please refer to SOP BRWM Hg01, MDEP Protocol For Collecting And Analyzing Mercury Vapor In Air With A Lumex Ra-915+ Mercury Analyzer, Revision 1, 04/02/2002.

2.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management [MDEP/BRWM] procedure for collecting and analyzing **solid** samples for mercury.

3.0 DEFINITIONS

3.1 SOP: Standard Operating Procedure

3.2 MDEP: Maine Department of Environmental Protection

3.3 Hg: Mercury

4.0 RESPONSIBILITIES

All Bureau Staff must follow this procedure when using the Lumex RA-915 for analysis of mercury in soil. Their respective supervisors and managers are responsible for ensuring that they are familiar with and adhere to this procedure, and receive the appropriate training and guidance to conduct fieldwork.

5.0 PROCEDURES:

5.1 Initial Instrument Check/ Maintenance
Follow instructions in SOP Hg01, MDEP Protocol For Collecting And Analyzing Mercury Vapor In Air With A Lumex Ra-915+ Mercury Analyzer, Revision 1, 04/02/2002 for calibration check, background air, and instrument maintenance. These are considered basic instrument procedures undertaken each time the instrument is used to assure proper function.

5.2 Set-up
Set up the equipment as described in section IV of OhioLumex Standard Operating Procedure OL-130.1, Using RP-91C Attachment for the Determination of Mercury in Solids, 09/02/2001.

5.3 Calibration

- A calibration range must be set for the project. A blank plus at least three standards bracketing the applicable range should be run.

- Calibration standards are produced as dilutions from purchased stock standards, and standard information recorded in the appropriate field notebook. All standards must be produced from NIST traceable material using Hg free methanol. Using a 1000 ng/ul stock standard, the following dilutions may be used as working standards:

Standard Concentration [ng/ul]	Volume Methanol [ml]	Volume stock [ul]
2	1 ml [minus 2 ul]	2
5	1 ml [minus 5 ul]	5
10	1 ml [minus 10 ul]	10

- Follow steps A through E in section V of OhioLumex Standard Operating Procedure OL-130.1, Using RP-91C Attachment for the Determination of Mercury in Solids, 09/02/2001 [OhioLumex SOP].
- Add 0.1g blank soil into a quartz sample boat and introduce 10 ul Hg free methanol.
- Allow the methanol to evaporate and press Start in the Integration window; then insert the boat in the oven.
- Follow steps G, H & I in section V of OhioLumex SOP.
- Introduce the first standard into a room temperature boat containing 0.1g blank soil and allow it to evaporate completely.
- Follow steps K & L in the OhioLumex SOP.
- Remove the standard boat from the oven and click the Table button on the Program toolbar. Double click the Description field for entry number 2. Select Standard, and the cursor will be present after Std__ at this point type in the standard concentration in parts per billion [ppb]. Enter the number of microliters [ul] standard introduced in the M column and press Enter.
- Introduce the next standard into a room temperature boat containing 0.1g blank soil and allow it to evaporate completely. Then repeat the steps K through entering standard information in the Table. These steps are repeated until all standards have been run and recorded.
- Follow steps O & P in the OhioLumex SOP to complete the calibration.

5.4 Analysis

- Use an appropriate sample size for the detection limit required by the project. Sample size should be kept under 0.2g. A sample size of 0.1g will yield a detection limit well below 1 ppm.
- Follow all steps in section VI of the OhioLumex SOP.

5.5 Quality Control

- Initial instrument check samples must be performed as in section 5.1. Acceptance parameters are listed in MDEP SOP Hg01.
- Balance accuracy should be verified each day of use by measuring the mass of a class s 1g weight. Mass should be within 0.01g accuracy.
- A reagent blank must be analyzed and show no Hg contamination at or above the reporting level of the test.
- Initial calibration curve must include at least three calibration standards. The initial curve must have an r^2 value of 0.95 or higher.
- Continuing calibration standards must be analyzed every 8 hours of operation and should have a result $\pm$ 20% true value.
- No results should be reported outside the range of the calibrants. If samples results are higher than the highest standard, either a smaller sample should be

analyzed or a higher calibration standard should be analyzed and included in the calibration curve.

- Each person that analyzes samples must run an initial demonstration of capability that includes analyzing four samples with the same known concentration of Hg. Acceptable accuracy [± 20% true value] and precision [≤ 20% RSD] must be demonstrated. This demonstration should be repeated on an annual basis.
- A percentage of filed test results should be confirmed by fixed laboratory analysis. The confirmation sample percentage should be set for each project.

5.6 Documentation

- Results of an initial demonstration of capability should be saved either as a hard copy report or in an electronic file by the analyst.
- All calibration standards should be recorded in bound field notebooks. Documentation should included concentration, expiration date and lot number of the stock standard as well as concentration and preparation steps for each of the working standards.
- Instrument check sample results should be recorded in bound field notebooks.
- Results of all samples with accompanying blank and calibration standards should be saved either as a hard copy report or in an electronic file by the analyst.

6.0 REFERENCES

OhioLumex Standard Operating Procedure OL-130.1, Using RP-91C Attachment for the Determination of Mercury in Solids, 09/02/2001

MDEP Protocol For Collecting And Analyzing Mercury Vapor In Air With A Lumex Ra-915+ Mercury Analyzer, Revision 1, 04/02/2002

Department of Environmental Protection
Bureau of Remediation & Waste Management
RCRA Program

Standard Operating Procedure Change Record

Title: **FIELD SCREENING OF SOIL SAMPLES UTILIZING THE JAR HEADSPACE TECHNIQUE**

Identification #: DR011

SOP Originator: Brian Beneski

Author	Revision	Description of Change	Date
Deb Stahler	RCRA 01	Substitute MEDEP/RCRA in the place of MEDEP/DR, and Division of Oil and Hazardous Materials in the place of Division of Remediation. Section 2.0 Introduction: Change first sentence to "MEDEP/RCRA is responsible for the investigation and subsequent corrective actions for RCRA facilities throughout Maine." Section 6.0 Procedure: Include the attached PID/FID calibration setpoints guidance for LUST. For LUST project decisions and site closure, use all procedures listed in Appendix Q of Chapter 691 as attached. Section 7.0 Additional Considerations with Use of PID/FID: Add sentence "When using the PID/FID to determine clean-up standards for petroleum use the attached set-points."	2/13/03

Approved by:

_____

Scott Whittier, RCRA Program Director Date:

Appendix Q: Field Determination of Soil Hydrocarbon Content by Jar / Poly Bag Headspace Technique

1. **Introduction.** The following is a procedure acceptable to the commissioner for determination of the hydrocarbon content of soils contaminated only by oil and petroleum products. A soil sample is placed in a sealed jar or polyethylene bag and the volatile hydrocarbons are allowed to come to equilibrium with the jar headspace. The headspace hydrocarbon concentration is then measured with a calibrated photo- or flame-ionization (PID or FID) instrument, approved by the commissioner.

2. **Applicability.** This procedure is intended for estimating gasoline, #2 heating oil, diesel fuel, kerosene, and other chemically and physically similar oil contamination in mineral soils, having water contents between bone-dry and saturation. The procedure is not intended for estimating concentrations of heavy oils, lubricating oils, waste oil, and other low volatility hydrocarbon products. Soil grain size distribution and organic carbon content may effect the partitioning of hydrocarbon between soil, liquid, and vapor phases. Weathering of the hydrocarbon product also will decrease the proportion of volatile and soluble constituents, thereby decreasing instrument response. None of these limitations invalidate the method as a technique for approximation of low-level petroleum hydrocarbon concentrations.

3. **Equipment Required.**

   A. Shovel; trowel;

   B. Lab containers (VOA or SVOA) of type and quantity for hydrocarbon to be sampled at expected concentrations;

NOTE: Laboratory should be consulted in advance to determine their needs.

   C. Metal dial-type thermometer, -10^{o}C to 50^{o}C;

   D. (Jar headspace method only) Glass, wide-mouthed, metal screw-top, 16 oz. jars, with cardboard lid liner removed, and 1/4" hole drilled through center of lid;

   E. (Jar headspace method only) Roll of heavy duty aluminum foil;
   F. (Poly bag method only) 1-quart, Zip-Lock® type polyethylene bags;

   G. Means of measuring 250 gm soil sample, plus or minus 10 gms. (e.g., a "calibrated" container, a "Weight Watchers" spring balance);

   H. Photoionization (PID), or flame ionization (FID) instrument approved by the commissioner;

NOTE: A list of approved instruments and their calibration set points is available from the commissioner. The department also has developed a protocol whereby manufacturers of other instruments may generate calibration data for commissioner evaluation and approval. Copies are available from the Bureau of Remediation and Waste Management.

   I. Calibration equipment for instrument chosen; and

J. Decontamination equipment including soapy water and clean distilled water in squirt bottles or pressurized canisters.

4. Analytical Procedure.

A. Determine the location at which the sample is to be taken. If possible, identify an uncontaminated location at the same site from which soil of similar texture and moisture content can be obtained, to serve as a field "blank".

B. Measure a 250 gm. sample of the soil into a wide-mouthed jar or polyethylene bag. In so far possible, samples should be mineral soil free of vegetation and stones larger than 1/2" in diameter. Seal the samples immediately in the jars by placing a square of foil over the mouth and screwing on the lid, and the bag by zipping the closure. Sufficient air should be left in the bag so that the instrument can withdraw an adequate headspace sample.

C. Repeat this procedure for three (3) more samples, all gathered within a 2'x2' area.

D. Shake the jars for 30 seconds to thoroughly mix the contents. If bags are used, they may be kneaded until the contents are uniform.

E. Measure the samples' temperature by sacrificing one jar or bag. If necessary, adjust all sample temperatures to between 15^{O}C and 25^{O}C by bringing sample containers into a warm vehicle or immersing in a water bath. In warm weather, samples should be kept in a shaded, ventilated area during headspace development and analysis.

F. Allow at least 15 minutes but not more than 1 hour for soil hydrocarbons to reach equilibrium with the headspace.

G. If samples are to be taken for laboratory analysis, they should be collected and preserved per laboratory protocols at this time. Preferably, these samples should bracket a wide range of hydrocarbon concentrations including the highest and lowest concentration at the site.

H. Warm up and calibrate the PID or FID instrument to be used to the calibration set point determined by the commissioner for the make of instrument in use and the product(s) present at the facility.

NOTES:

1. These calibration set points have been established by testing the instruments against weathered petroleum headspace surrogates. Therefore no conversion of the readings to their benzene equivalent is necessary.

2. The UV source in PID instruments should be cleaned at least weekly per the manufacturer's recommended procedure. Both PID and FID instruments must be recalibrated after four hours of continuous use, as well as at the beginning of field use, since their calibration may drift with battery condition.

I. Shake the jars or knead the bags again for thirty (30) seconds.

J. Measure the samples' headspace concentration. If the jar headspace technique is used, break the foil seal through the drilled hole in the jar lid using a pencil or nail. Insert the instrument's probe about 1/2" into the jar. If using the poly-bag technique, insert the probe through the bag opening while squeezing the bag tight around the probe. Record

the highest reading that remains steady for 1-2 seconds (i.e., that is not due to instrument needle inertia). Repeat this step until all jars have been measured.

NOTE: Both PID and FID instruments withdraw a headspace sample from the jar. In the jar headspace technique, air replaces this sample, diluting the headspace as it is being measured. In the poly bag technique, the bag collapses as its headspace is used by the instrument. In either case it is important to obtain an instrument reading immediately after the seal is broken -- preferably within 10 seconds. Once a jar or bag has been used, it may not be used again, even if sufficient time is allowed to re-establish headspace equilibrium.

K. Repeat all steps at each other location of interest at the site. Finally, repeat all steps for the "field blank" obtained from the uncontaminated location.

L. Average the three readings obtained from each soil sample within each 2'x2' area. Blank results must be reported but must not be used to adjust the readings obtained on other samples.

NOTE: Because calibration set points have been established by testing the instruments against weathered petroleum headspace surrogates, no conversion of the readings to their benzene equivalent is necessary.

DATE: September 8, 1997

TO: All Persons Performing Site Assessments Pursuant To "Regulations for Registration, Installation, Operation & Closure of Underground Oil Storage Facilities (Appendix P of CMR, Chapter 691)"

FROM: George Seel, Director
Division of Technical Services
Bureau of Remediation & Waste Management

SUBJ: Calibration Set Points For Photoionization (PIDs) and Flame Ionization Detectors (FIDs) Used in Field Headspace Determinations at Maine UST and LUST Sites

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The following table gives the set points for various PIDs and FIDs when calibrating with 100 ppm isobutylene span gas. **Only the makes and models of instrument listed below may be used in Maine site assessments, where these are required by Chapter 691.** The notification level using instruments adjusted to these set points is 100 ppm, regardless of the petroleum product being measured. Instruments calibrated to these set points may also be used to determine compliance with the cleanup standards at Baseline-

2 (BL-2) sites, per the *DEP Procedural Guidance For Establishing Standards For The Remediation Of Oil-Contaminated Soil And Groundwater In Maine* ("Decision Tree").

Instruments may be made to read directly, either by by entering the appropriate set point when the calibration routine requests the span gas concentration, or by adjusting the instrument's span until the set point reading is obtained. As an alternative, the instrument may be calibrated to the actual span gas concentration and readings are then multiplied by the set point divided by 100, producing the equivalent result. (e.g., a reading of 35 made with an HNu HW-101 at a gasoline site would be multiplied by 440/100 or 4.4 to produce a corrected reading of 154). Headspace concentrations obtained by either method should not be corrected to "benzene equivalents," as suggested by some instrument manufacturers.

If isobutylene span gas having a concentration other than 100 ppm is used, the set point should be adjusted proportionally (e.g., when calibrating a Thermo 580S using 250 ppm isobutylene, the set points should be multiplied by 250/100 or 2.5, producing set points of 637 and 800, respectively, for gasoline and fuel oil work).

This list is periodically updated as set points are established for additional instruments. For the most current listing, please contact the Division of Technical Services, Bureau of Remediation & Waste Management at (207) 287-2651.

A protocol is also available, whereby manufacturers of unlisted PID and FID instruments can generate validation data for DEP's evaluation. For further information, please contact the Division of Technical Services.

Instruments	**Set Point for**	**Set Point for #2**
PID	**Gasoline Sites**	**Fuel Oil Sites**
HNu PI-101, HW-101, ISPI-101, DL-101	440	520
MSA Photon Gas Detector	225	225
MSA Passport PID II OVM	210	355
MicroTIP MP-1000, HL-2000, IS-3000	225	225
Thermo OVM 580B, 580S	255	320
Environmental Technologies "Determinator"	255	320
Foxboro TVA-1000	265	330
FID		
Thermo OVM Model 680	80	45
Foxboro TVA-1000	90	60

FIELD SCREENING OF SOIL SAMPLES UTILIZING THE JAR HEADSPACE TECHNIQUE

Maine Department of Environmental Protection
Division of Remediation

Standard Operating Procedure: **DR#011**
REVISION: **#1**
DATE: **January 21, 1999**
Written/Revised by: Brian Beneski
Reviewed by: Troy Smith

1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Site Remediation's (MEDEP/DR) procedure for field screening volatile organic content of soils using a "Jar Headspace Technique" (JHT) with a photoionization detector (PID) or a flame ionization detector (FID).

2.0 INTRODUCTION

MEDEP/DR is responsible for the investigation and remediation of uncontrolled hazardous substance sites throughout Maine. The procedure described in this procedure will provide a screening tool for determining relative levels of volatile organic compounds (VOCs) present in soil with a field PID or FID instrument. This methodology is not to replace actual laboratory analysis; it is to provide a screening tool in the field for determining "hot spots" and other areas of high or low concentrations of VOCs presence in soil, or for when choosing samples from a site for laboratory analysis.

In conducting this procedure, a soil sample is placed in a sealed jar or polyethylene bag and the volatile constituents are allowed to come to equilibrium with the jar headspace. The headspace is then measured with a calibrated PID or FID, with a result expressed in parts per million (ppm). Due to the different ionization potentials of various compounds, actual levels of contamination cannot be determined. However, this technique provides an effective means of screening soil to determine "hot spots", extent of contamination, and as a means of screening samples for submittal for laboratory analysis.

3.0 SCOPE AND RESPONSIBILITES

This procedure applies to all staff in the MEDEP/DR who are involved with performing field activities in the investigation of uncontrolled hazardous substance sites. Generally, it is the field personnel of MEDEP/DR and MEDEP/Technical Services (MEDEP/TS) (the Oil and Hazardous Materials Specialist positions and Geologist positions) who

will be responsible for performing this task. Project managers of MEDEP/DR can assist and/or perform this task with field personnel present, or after receiving specific training in this activity.

All managers and supervisors are responsible for ensuring that staff who are responsible for performing this procedure understand and adhere to it for all events.

4.0 EQUIPMENT

The following equipment is required for conducting the JHT:

-- Soil sampling equipment (shovel, bucket auger, soil borer;
-- Wide mouthed, metal screw top 16 oz jars, with cardboard lid liner removed, and ¼ inch hole drilled through center, and roll of heavy duty aluminum foil; **or**
-- One quart, zip lock type polyethylene bags;
-- PID or FID – MEDEP/DR personnel has use of the following PIDs:
    -- Foxboro TVA-1000B Toxic Vapor Analyzer with PID, a second TVA-1000B is available from MEDEP/TS with dual PID and FID;
    -- Thermo Environmental Instruments 580 organic vapor monitor;
    -- HNU PID,
    -- Photovac Microtip PID (MEDEP/TS owned)

    (The manuals for these instruments can be found with the OHMS Staff); and
-- Calibration equipment, including users manual, for particular PID or FID to be used.

5.0 PROCEDURE

1- Collect the soil sample, as outlined in the site specific Sampling and Analysis Plan (SAP)(See SOP DR#014 - Development of a Sampling and Analysis Plan) with appropriate soil sampling equipment.

2- Place approximately 250 grams of the soil sample into a wide mouth jar or polyethylene bag, as stated in the SAP. One or the other should be consistently used at the site for comparison purposes, do not mix headspace containers. In so far as possible, samples should be

mineral soil free of vegetation and stones larger than ½ inches in diameter. If soil samples are of different type (loam, sand, silt), this should be identified in the field log book. If a duplicate sample is to be submitted to the laboratory for analysis, this sample should be containerized and preserved as appropriate **now**. Soil that has been screened with JHT should not be submitted for laboratory analysis, unless so documented. If using jars, the jars should be sealed now by placing a square of foil over the mouth and screwing on the lid. If using a bag, the bag should be zipped closed leaving sufficient air in the bag so that the instrument can withdraw an adequate headspace sample.

3- Shake the jars for 30 seconds to thoroughly mix the contents. If bags are used, they may be kneaded until the contents are uniform.

4- Allow at least fifteen minutes but not more than two hours for VOCs to reach headspace equilibrium with the headspace. An attempt should be made to allow the same amount of equilibration time for each sample.

5- Warm up and calibrate the PID and FID instrument to be used according to the manufacturers recommended procedure (See Section 7 - Additional Considerations With Use of PID/FID). The PID and/or FID should be ready for use prior to collection of the first sample.

6- Shake jars/knead bags again for thirty seconds.

7- Measure the samples headspace concentration with the instrument. If the jar is used, break the foil seal through the drilled hole in the jar lid, and insert the probe approximately ½ inch into jar. If using the poly bag, open the seal just enough to insert the probe (this is easiest using two people). Record the highest reading on the instrument after allowing the probe to "sniff" the container for 10 – 15 seconds. It is important to obtain insert the probe as quickly as possible after the seal to the container has been broken. Once a jar has been used, it may not be used again for JHT screening.

7.0 ADDITIONAL CONSIDERATIONS WITH USE OF A PID/FID

The are limitations of PIDs and FIDs. A PID and FID cannot detect all VOCs, nor do they detect all VOCs equally. Factors that influence the response of the particular compound include ionization potential of compound, particular energy rating of lamp, calibration standard used, response factor, response curve, etc. In some instances, such as when the contaminant of concern is a single known compound, it is possible to calibrate the instrument so that a relatively accurate measurement, when compared to laboratory analysis, can be obtained. Because of this, it is recommended that the operator of the particular instrument that will be conducting JHT take the time before the sampling event to familiarize themselves with the particular instrument that will be used, if they are not already familiar with that instrument. This includes reviewing the specific user manual, and calibration and practice with the instrument prior to the sampling event.

6.0 DOCUMENTATION

Field notes should be collected following the standard procedures outlined in SOP DR#013 - Documentation of Field Activities and Development of a SETR. It is important that documentation include the specific lamp energy rating, calibration standard, and special response factors or curves that may be employed for the particular sampling event. When documenting such a sampling event, one should include enough information so that a person at a latter date can easily conduct the same sampling and receive the same results.

PROTOCOL FOR COLLECTING DATA USING A MSA PASSPORT II ORGANIC VAPOR MONITOR

Maine Department of Environmental Protection
Division of Oil and Hazardous Waste Facilities Regulation

Standard Operating Procedure: **PID**
Revision: **2**
Revision Date: **July 2002**
Written by: **Mary Corr**

1. PURPOSE

This document provides guidance to the Division of Oil and Hazardous Waste Facility Regulation Staff for the use and care of the MSA Passport II Organic Vapor Monitor (Passport) to analyze samples for volatile organic compounds at work sites. This guidance will apply to all work sites that Division personnel visit, or work on.

2. INTRODUCTION

Division Staff are responsible for the investigation of oil and hazardous waste sites throughout Maine. This standard operating procedure (SOP) is designed to be a guideline for data collection with a Passport. This is a field screening method, which may be used for:

Field Screening – The Passport may be used for: profiling an area, locating sources of contamination, determining the horizontal or vertical extent of contamination, monitoring the effectiveness of mitigation measures, or collecting preliminary data that will be used to design a sampling plan.

Sampling soil headspace – See the SOP for Field Screening Of Soil Samples Utilizing the Jar Headspace Technique DR # 11 written by Brian Beneski

Zip locking bags or glass jars with lids and tin foil are needed to conduct soil headspace analysis. After an appropriate soil sample has been obtained, put about 250 grams of sample into a jar or ziplock bag. Seal the container and shake for about 30 sec. Allow between 15 minutes and 2 hours to warm the samples to 15° to 20° C and allow the VOCs to reach equilibrium with the headspace. Shake the container again for 30 sec. Then, insert the Passport probe and record the highest reading in the appropriate field data sheet or field notebook.

Site Safety – It should be noted that PIDs in general are <u>total</u> organic vapor analyzers, and not all compounds can be ionized by a PID. PIDs are sensitive to all compounds in the sample matrix that can be ionized by the ultraviolet (UV) lamp in the PID. The Passport has no way of discriminating between different compounds, so it is important to know, by other means, what the contaminants are at a given site before using the PID for breathing zone monitoring and/or for site safety. A PID shall not be relied upon as the sole instrument used for site safety unless the user knows: the contaminant(s), the ionization potential for the contaminant(s), the correction factors or set points for the contaminant(s), and the applicable safe work levels (such as permissible exposure limit, time weighted average, short-term exposure limit etc), and after other measures have been implemented to eliminate the hazards, and protect staff. This should be addressed in the Site Safety Plan prepared prior to visiting the project site.

Unprotected Division Staff may not enter any space where they have any expectation that unsafe contaminant levels may be present, without a Site Safety Plan designed to address the specific site issues. This instrument must not be used in confined spaces without proper training, monitoring, and permits required in the Department's Confined Space Policy.

Unsafe contaminant levels wouldn't normally be expected where Division Staff are conducting routine inspections of actively operating businesses and in areas where staff of the business are normally expected to work. Division Staff will use caution and limit their exposure to any contaminants.

3. RESPONSIBILITIES

Division Staff must follow this procedure when using the Passport. All supervisors are responsible for ensuring that their staff is familiar with and adhere to this procedure prior to using the PID. The User Group Monitoring Equipment Coordinator (UGMEC) is responsible for determining who will be eligible to use the Passport and providing the training. For the Division of Oil and Hazardous Waste Facility Regulation Staff, the UGMEC for the Passport is the OHMS II in Augusta, with regional assistance from the ES III in Bangor and the OHMS II in Portland. There is one Passport for each office.

4. BACKGROUND

The Passport is a portable organic vapor meter, which detects and quantifies most organic vapors with a highly sensitive photoionization detector. The Passport has an operating range of 0.1 to 10,000 parts per million (ppm) with a minimum detection of 0.1 ppm. The Passport operates on an internal battery that can hold a charge for about 8 hours of continuous operation at 25 degrees centigrade. The battery is rechargeable with the charger provided with the instrument.

The Passport uses an UV lamp of a specific energy and an ionization chamber. Compounds passing through the chamber are excited by the photons of the UV lamp and are ionized. These ions are attracted to a collecting electrode, producing a current proportional to the concentration of the compound. Whether or not a compound can be detected by the PID depends upon the energy needed to remove an electron from the compound. This is referred to as the compound's ionization potential. If the lamp energy is greater than the compounds ionization potential, the Passport will detect it. Conversely, if the ionization potential of the compound is greater than the lamp, the Passport will not detect it. The Passport has a 10.6ev lamp as standard equipment. Lamps of different voltages may be substituted to expand the range of detectable compounds. The Passport users manual has a list of ionization potentials for over 400 chemicals in Appendix E. A copy of the operation manual for the Passport must be included in the case with each instrument. The operator should be familiar with this manual, as it is the MDEP policy that operation of instruments should follow the manufacture's recommendations.

5. EQUIPMENT

The Passport has a display screen for messages and measurement readings, and three buttons on the front. The left button is called the 'page button', the center button is the 'on/off button', and the right button is the 'reset button'. All three buttons may have multiple uses. The lamp cover and earphone jack are on the right side of the instrument. The outlet port is on top, and the inlet port and data port are on the back over part of the installed battery pack. The data port and earphone jack are not used at this time by the Division of Oil and Hazardous Waste Facility Regulation Staff.

Also included with the Passport in the carrying case are:
Battery chargers for vehicle (P/N 71043) and wall receptacle (P/N 494716)
Alternate battery case for three alkaline "C" batteries
Sample probe tip with water/dirt filter
Isobutylene calibration gas with regulator and tubing
Copy of instruction manual

Alarms Alarms include; horn sounds, alarm light, and status messages to indicate which alarm threshold was violated. The sound can be temporarily inactivated by pressing the reset button.

Concentration Alarms The Passport has a number of internal alarms, which may be set by the user prior to use. If these are in alarm mode, the displayed concentration will flash. Users may set levels for; a warning level, alarm level, time weighed average, and short-term exposure level. Refer to the instrument manual for additional information and instructions to set these alarms.

System alarms These alert the user to problems such as low battery, obstructed pump or lamp out. When the alarm sounds the display informs the user of the specific cause of the alarm. The user should correct the problem if able, and then reset the alarm by pressing the reset button, or notify the UGMEC, and take the instrument out of service. Refer to the instrument manual for additional information.

6. PROCEDURES FOR PASSPORT USE

The user manual contains instructions that are more detailed

Preparation

It is the responsibility of the user to check the equipment prior to use to make sure the Passport is operating correctly and all of the listed equipment items are included in the instrument carrying case. If the Passport appears to be malfunctioning or equipment is missing, the OHMS II or ES III charged with care of the instrument should be notified immediately. The instrument should then be tagged out of service until the instrument is fixed or the equipment replaced.

The daily check should include; calibration check, user selections check, and battery status check.

Calibration Check
Attach the calibration tubing and calibration gas and allow the instrument to stabilize. The concentration on the bottle should be within 5% of the displayed concentration. If the reading difference is greater than 5%, refer to the calibration section below for full calibration prior to use. The supplied isobutylene calibration gas is 100 ppm isobutylene so the reading must be between 95 ppm and 105 ppm or the Passport must be re-calibrated.

User Selections
The user has several options upon start up. These are accessed by pressing the page button. The user may elect to set: date and time, peak reading, short term exposure limit, time weighted average, one of 69 sample gas response factors, label, and warning level. The Division of Oil and Hazardous Waste Facilities Regulation will use isobutylene, unless the contaminant is known and that contaminant is included in the 69 sample gasses listed. Refer to the instrument manual for additional information. The Augusta office of The Response Services Division has the ability to program in additional response factors.

Operation.

Start up The instrument is turned on by pressing the on/off button. The Passport will do a self-test and internal check. The user will then be given the option of doing a fresh air setup to zero the instrument. If you are in an area away from contamination, fresh air setup may be selected. If you are starting the instrument at a site where there are noticeable VOC vapors in the ambient air the fresh air set up should be skipped until the user is in an area expected to be free of vapors, or a canister of "Zero Air" should be used for the fresh air set up. The Passport is not supplied with zero air as standard equipment.

After the air check, the instrument will begin to display readings. The user should check the pump by plugging the inlet or the free end of the sampling probe. The alarm will sound, the pump shut off and then restart if the line is unplugged. The reset button will stop the alarm.

Attach the probe tip with the water/dirt filter to the inlet port.

Readings may now be taken following the site sample plan for the site.

Shut down To turn the Passport off. Hold the on/off button down for 6 seconds.

Calibration

The Passport does not need to be calibrated before use every day if the calibration check is within 5% of the concentration of the span gas used. As the instrument can drift during use, it may be necessary to calibrate more then once a day during use. A source of "zero air" and "span gas" are needed to calibrate the Passport. For the Passport, 100 ppm

Isobutylene gas is used for the span gas. Zero air is usually the ambient air. However, if you are attempting to calibrate the instrument at a site where there are noticeable VOC vapors in the ambient air, a canister of "Zero Air" should be used.

When the Passport display is not within 5% of the calibration gas, turn the instrument off. Start the calibration sequence by holding the page and reset buttons simultaneously. While continuing to hold these two buttons, press the on/off button and the instrument displays "calibrate now?" Follow the display prompts to apply background air (zero air), span gas, and adjust the display reading to match the calibration gas. When the display reading matches calibration gas, level select OK (on/off button). At this point calibration is complete and the instrument will shut off.

Refer to the manufacture's operation manual for calibration details and instructions.

7. DOCUMENTATION

All sampling activity should be documented according to the site specific sampling Plan. The following should be noted:

- Project name
- Date and time of recording
- Background air results
- Verification of calibration
- Name of person(s) performing the analysis
- Results
- Any special considerations or sampling conditions

8. CLEANING AND ROUTINE MAINTENANCE

Section 6.4 of the user manual has a troubleshooting Guide. Users should only attempt the corrective actions suggested in the table in 6.4. If the Passport appears to be malfunctioning or equipment is missing, the OHMS II or ES III charged with care of the instrument should be notified immediately. The instrument should then be tagged out of service until the instrument is fixed and the equipment replaced.

The instrument should be wiped down with a damp cloth to remove any soil or grime prior to placing back in the carry case. Do not submerse the instrument in water or any other solution, as this will severely damage the instrument.

The OHMS II s or ES III may perform other Maintenance described in section 6.5 of the user manual if they feel they are able to perform the action.

The Passport should be charged every evening after operation. The charge is regulated so that it cannot overcharge the battery and damage the instrument.

Daily

At the end of a sample event, the user will record the use, battery charge, calibration and any maintenance in the instrument log kept with the instrument.

Monthly

Once a month, the instruments are checked by the appropriate office coordinator. This involves a battery and calibration check to indicate that the instrument is operating properly. This information is then recorded the instrument log. The log also records when repairs have been made, what they were, date of purchase etc. If any instrument is found to be not operating correctly, the UGMEC should be informed immediately, the instrument is to be tagged out immediately and taken out of service until repairs have been made and the instrument is operating correctly.

Every 40 hours of use

The lamp should by cleaned after 40 hours of use following the instructions in the user manual.

9. TRAINING

Prior to use, personnel must demonstrate an ability to operate the Passport and understand what the readings mean. In addition, operators will need to demonstrate on a yearly basis their proficiency in using the Passport. This will be accomplished as part of a yearly refresher or individual lesson with the UGMEC, regional assistant, or designee. A list of approved users will be kept with the UGMEC.

10. RECORD KEEPING

The Enforcement user group shall maintain a logbook recording the user group's history of instrument use. This logbook (including all instruments) shall contain:

Section I - A list of qualified users in the group indicating which monitoring equipment they are qualified to use and the date their proficiency was checked. (Proficiency must be checked at least annually.)

Section II - A list of site monitoring equipment maintained by the unit both in and out of service.

Section III – An equipment log for each unit of monitoring equipment shall be kept with the instrument, and a copy of this record will be submitted to the UGMEC at least once per year. This equipment log includes:

- When the unit of monitoring equipment instrument was first put into service;
- Periodic (monthly preferred) performance, battery and calibration checks of the unit of monitoring equipment;
- When the instrument was used, by whom, and under what conditions;
- Decontamination the monitoring equipment has undergone
- Repair history of the monitoring equipment.

Section IV - A record of the quality control checks made by the User Group's Coordinator of site monitoring equipment maintained by the group (annually preferred).

Section V - Copies user manuals and written user group procedures (SOPs) for each type of monitoring equipment available for use by the unit.

11. DEVIATIONS FROM SOPS

All deviations from the procedures outlined in this or in any other, SOPs followed for using the Passport must be documented in field notes.

12. REFERENCES

MSA Passport II Organic Vapor Monitor User's Manual

Bureau of Remediation and Waste Management's Department of Environmental Protection, *Site Monitoring SOP*

Department of Environmental Protection
Bureau of Remediation & Waste Management
RCRA Program

Standard Operating Procedure Change Record

Title: CHAIN OF CUSTODY PROTOCOL

Identification #: DR012

SOP Originator: Brian Beneski

Author	Revision	Description of Change	Date
Deb Stahler	RCRA 01	Substitute MEDEP/RCRA in the place of MEDEP/DR, and Division of Oil and Hazardous Materials in the place of Division of Remediation. Section 2.0 Introduction: Change first sentence to "MEDEP/RCRA is responsible for the investigation and subsequent corrective actions for RCRA facilities throughout Maine."	5/31/02

Approved by:

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Scott Whittier, RCRA Program Director Date:

CHAIN OF CUSTODY PROTOCOL

Maine Department of Environmental Protection
Division of Site Remediation

Standard Operating Procedure: **DR#012**
REVISION: **#4**
DATE: **January 26, 1999**
Written/Revised by: Brian Beneski
Reviewed by: Denise Fournier

1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Remediation's (MEDEP/DR) procedure for chain of custody documentation.

2.0 SCOPE

This procedure applies to all staff in the MEDEP/DR who are involved with collecting samples from locations at or near uncontrolled hazardous substance sites. This procedure describes each step to be followed for chain of custody documentation from the collection of the samples until they are turned over to the laboratory.

3.0 Introduction

The MEDEP/DR uses standard operating procedures(SOP) as guidance in performing many tasks. This SOP establishes the proper methods for implementation of sample chain of custody documentation and procedure, and should insure consistency among MEDEP/DR staff. Proper sample chain of custody procedures are essential to collecting valid information which may be used in any legal proceedings.

4.0 RESPONSIBILITIES

All MEDEP/DR staff must follow this procedure when performing activities involving the collection of samples. All Managers and Supervisors are responsible for ensuring(via training, required reading, etc.) that their staff understand this procedure and strictly adhere to it for all sampling events.

4.1 Definitions

-- Chain of Custody Form--Documentation detailing who is legally responsible for samples at any point in time from collection until the sample results or actual samples are used in legal proceedings.
-- Custody--A sample is "in custody" when: 1) the sample is in the sampler's possession, or 2) the sample is in the sampler's view, after being in the sampler's possession, or 3) the sample was in the sampler's possession and then locked up by the sampler to prevent tampering, or 4) the sample is placed in a designated secure area.

-- Secure Area—An area in which entry is limited by keyed lock to a designated population.

5.0 GUIDELINES/PROCEDURES

Failure to maintain possession in the ways outlined in this SOP would constitute a break in sample custody and would likely discredit this sample as use of evidence in court proceedings. The sampler must assume that all samples collected will some day be used as evidence in court and treat the task of sample custody accordingly.

Whenever possible, all samples will be checked into the laboratory performing the analyses on the same day the samples are collected. If it is impossible to check in samples at the laboratory the same day, the samples should be placed in a secure area, following appropriate protocol for sample preservation (such as cooling to 4°C). The most appropriate location for overnight storage is the sample refridgerator located in the locked clean room in the MEDEP/Technical Services (MEDEP/TS) warehouse. These samples will be kept secure and cool in a locked refrigerator until the next business day, when the samples may be checked in to the laboratory.

For overnight trips or other times when it is not possible to check the samples into the laboratory or secure them at the MEDEP/TS Warehouse, the samples should be stored in a secure area (i.e. a locked motel room, locked truck, locked personal residence), again following appropriate sample preservation. If samples are not checked into the laboratory the same day as collected, the storage location and means of providing security shall be documented in the Sampling Event Trip Report (SETR) (See Standard Operating Procedure DR#013, Field Documentation). During the winter months the sampler must make sure the samples are kept from freezing while being stored.

5.1 Sample Chain of Custody

The completed sample chain of custody form is the documentation corresponding with and detailing the custody of the sample from the time the sample was collected until the samples or the results of analysis are introduced as evidence in legal proceedings. All information obtained in the field pertinent to the samples should be recorded in a field notebook by the sampler in charge of sample custody (See SOP: Documentation of Field Notebooks). The chain of custody form will document the information identifying the sample and a

record of the relinquishing and receiving individuals. MEDEP/DR personnel will use the "Maine Department of Human Services, Health and Environmental Testing Laboratory Sample Record" (see Attachment A) as the appropriate chain of custody form.

5.2 Procedure for Completion of Chain of Custody

Samplers from the MEDEP/DR will complete the following sections of the Maine Department of Human Services Health & Environmental Testing Laboratory Sample Record (sample record) as the samples are obtained (Refer to Attachment A for corresponding numbers):

1) Appropriation/Activity Number--this section should have the appropriate account number for payment of the sample analysis. The project manager should be able to provide the sampler with the appropriate account number.

2) Project Name--give the complete and correct name for the site where the samples were taken from.

3) Town/County--give the correct town and county where the site is located(no minor civil divisions for towns).

4) Sampler(s)--the sampler(s) should sign in the space(s) provided.

5) Results to--this section identifies the person who should receive the results(usually the project manager).

6) Requester Remarks--this section should include any specific instructions regarding the samples(i.e. watch for high contamination, analyze a certain sample first, use drinking water standards as a detection limit).

7) Location--provide unique identification of the sample location which will adequately distinguish this location from another.

8) Time--record the time at which a sample was obtained.

9) HETL Number--record the numbers from the sample containers that correspond with each sampling location.

10) Type--identify the type of sample taken(i.e. grab, composite, core, or duplicate).

11) Preservative--identify if a preservative was used or specifically identify the preservative(e.g. HNO_3 or NaOH).

12) Matrix--identify the matrix of the sample(i.e. water, air, soil, or neat).

13) Analyses Requested--identify the appropriate analyses requested for each sample.

14) Chain of Custody--this section is extremely important to the recording of the custody of the sample. In this section, the person(s) responsible for custody of the sample from the time the sample was collected until it was checked into the lab must sign in the "Relinquished by" section. All changes of sample custody must be recorded on this sample record. The receiving official in the lab must check that the sample information recorded corresponds to the samples received. Once the receiving official is satisfied that the record accurately represents the samples provided, the receiving official must sign in the "Received by" section and fill in the DATE/TIME section appropriately.

15) Date--The year, month, and day of the collection of the samples listed on the chain will be completed by the sampler. This section is located below the Chain of Custody section and just above the sample information section.

5.3 Disposition of Completed Chain of Custody

Once the paperwork is completed, the laboratory completing the analysis should retain the white original. The sampler should retain the last (usually pink or yellow) carbon copy. The transporter(s) of the samples should retain any additional carbon copies, if any are available.

6.0 DOCUMENTATION

The sampler responsible for insuring the custody of the sample is responsible for insuring that all the appropriate paperwork is completed to document the chain of custody of the sample. This sampler must record all information pertaining to the sample in his/her field notebook (following SOP DR#013), and make sure that all the pertinent information is accurately transferred to the sample record. The sampler must insure that all relinquishing and receiving officials sign, date, and

note the time of each switch of sample custody. The sample record number, located in the upper right-hand corner of the sample record sheet, should be recorded in the sampler's field notebook and the corresponding trip report. Failure to properly follow these record-keeping procedures may discredit the sample as evidence in legal proceedings.

After check-in of samples has been completed at the lab, the sampler should return the carbon copy of the sample record to the project manager of the site. The project manager should keep possession of this copy until the results are returned from the lab. The carbon copy of the sample record should then be attached to the results and placed in the appropriate site file. Following these procedures will insure that the chain of custody of the samples on the sample record has been maintained.

7.0 References

U.S. Environmental Protection Agency, "Sampling of Hazardous Materials", EPA, April 1990.

Department of Environmental Protection
Bureau of Remediation & Waste Management
RCRA Program

Standard Operating Procedure Change Record

Title: **DOCUMENTATION OF FIELD NOTES AND DEVELOPMENT OF A SAMPLING EVENT TRIP REPORT**

Identification #: DR013

SOP Originator: Brian Beneski

Author	Revision	Description of Change	Date
Deb Stahler	RCRA 01	Substitute MEDEP/RCRA in the place of MEDEP/DR, and Division of Oil and Hazardous Materials in the place of Division of Remediation. Section 2.0 Introduction: Change first sentence to "MEDEP/RCRA is responsible for the investigation and subsequent corrective actions for RCRA facilities throughout Maine."	5/31/02

Approved by:

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Scott Whittier, RCRA Program Director Date:

DOCUMENTATION OF FIELD NOTES AND DEVELOPMENT OF A SAMPLING EVENT TRIP REPORT

FOR

MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION'S

DIVISION OF SITE REMEDIATION

Standard Operating Procedure: **DR#013**
Revision: **#3**
DATE: **May 13, 1999**
Written/Revised by: Brian Beneski
Reviewed by: Jean Firth

1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Remediation's (MEDEP/DR) procedure for documenting field actions.

2.0 SCOPE

This procedure applies to all MEDEP/DR staff who participate in conducting field work or site visits and are responsible for documenting the events of these visits. This procedure outlines how field notes must be written to ensure that this information will be acceptable if it is required as evidence in legal proceedings.

3.0 RESPONSIBILITIES

All Uncontrolled Sites Program Staff involved with performing site visits and documenting the activities which occurred are required to follow this procedure. All Managers and Supervisors are responsible for ensuring that their staff are familiar with and adhere to this procedure. MEDEP/DR will provide the appropriate field books; staff will request field books from the OHMS staff in MEDEP/DR as needed; an inventory of field books will be kept in stock.

4.0 DEFINITIONS

Field Notebook - Bound books with water resistant pages in which information from field activities is documented.
Field Notes – Information gathered during a sampling event or some other field activity at nearby, or in some other way associated with a known or suspected hazardous substance site.

5.0 GUIDELINES/PROCEDURES

The are several reasons for taking field notes when visiting sites. These include:

-- Noting information in the field for its use, such as recording low flow well field parameters for comparison purposes to determine stabilization;
-- To provide a record of current conditions at a site;
-- To document specific activities at a site;
-- To allow the re - creation of an event by persons not at the site (for comparing data of different events); and
-- To provide a means of reviewing the activities at a site if quality concerns with data collected during the site visit are uncovered.

All field notes should be taken with these mentioned purposes in mind.

All field notes, with the stated exceptions, will be kept in the standard field book issued by MEDEP/DR OHMS.

For field events with multiple personnel present, it is not necessary for each participant to take field notes. The person(s) responsible for taking field notes and completing the Sampling Event Trip report (SETR) will be stated in the Sampling and Analysis Plan (SAP) or Quality Assurance Project Plan (QAP) for the event (See MEDEP/DR SOP DR#014 - Development of a Sampling and Analysis Plan; SOP DR3016 - Development of a Site Specific Quality Assurance Project Plan (QAPP)).

5.1 Initializing Field Book

Upon Receipt of a Field Notebook, enter your name, DEP address, and phone number on the inside front cover. Give field book a specific designation (site name and book number for site specific field books i.e. Joe's Garage, Book 1), or year book number for general field books, i.e. 99 – 1) Then number all pages in order, being sure not to skip pages.

5.2 Site Documentation

Upon arrival at a site, the following information must be written down in the field notes: 1) Date of field activity; 2) Site or project name and location; 3) names of persons visiting site, including who they represent and their positions or roles; 4) time of arrival; 5) weather conditions.

After completing the header, take field observations as necessary.

At the bottom of each page, and at the end of each day or event, sign and date the field book.

Do not doodle on pages or document personal comments. Additionally, only blue or black ink should be used. Pencils must never be used.

Given the variety of circumstances that can be found, it is difficult to provide a minimum for documentation. However, the following list should be considered a guide for documentation:

-- Names of personnel present and organization;
-- The sample event date and time;
-- weather conditions;
-- field measurements (such as PID readings, pH, temperature, etc);
-- sample station location designations, sample container numbers, etc;
-- Specific sample location information, such as depths of sample, tide conditions, soil conditions, water color/conditions, etc;
-- Out of the ordinary events, such as equipment failure, damage to monitoring wells or evidence of tampering, observations of gross contamination, odors, etc;
-- Information the field staff believe may be useful or pertinent at a later date.

The field notebook must be kept organized, legible, and accurate because it may be used as evidence in court proceedings.

5.3 Correcting Errors

Do not scratch out or blacken over error. Place one line through error, initial it, and continue with correct information. Never rip out or otherwise remove a page from a field book.

5.4 Reference to Other Field Log Forms

Some field activities have specific forms for taking notes. If forms are used, a field book entry must be made with reference to the forms used during that event. Currently, the MEDEP/DR and MEDEP/TS have the following forms for notes:

-- Low flow purge and sampling of monitoring wells
-- Soil boring/test pit logs
-- Elevation survey forms
-- Residential water supply survey form
-- Container survey form
-- Well development form
-- Sample log sheet

Copies of these forms can be found in Attachment A. If these forms are used, the field book must reference these forms.

6.0 SAMPLING EVENT TRIP REPORT (SETR)

After each field event, a sampling event trip report (SETR) package must be completed within one week of the event. If the field event has multiple MEDEP/DR staff present, the person responsible for completing the SETR will be stated in the SAP. At a minimum, the SETR will consist of the SETR form completed (found in Attachment B), with photocopies of all field notes taken by all personnel during the event, and copies of chains of custody for samples. It is also recommended that a summary memo to the file be developed and attached to the SETR form which outlines the field events purpose, activities, and outcomes, and other relevant issues.

Once completed, the original SETR package will placed in the Project Site File through Site the Sites' project manager. An additional copy will also be placed in the Site Assessment and Support Services (SASS) Trip Report file which is kept with the MEDEP/DR Quality Assurance Coordinator.

RCRA Program Field Trip Report

Date:	**Weather Conditions:**

Site Name and Location:

MEDEP Personnel Present:

Other People Present:

Purpose of Site/Area Visit:

- ☐ **Reconnaissance**
- ☐ **Inspection**
- ☐ **Sampling Monitoring Wells**
- ☐ **Waste Sampling, Drums, Stained Soil, Other**
- ☐ **Soil Sampling**
- ☐ **Surface Water/ Sediment Sampling. Water Body_____**
- ☐ **Contractor Oversight**
- ☐ **Other:**

Field Notes and Sample Numbers Recorded by:

Additional Comments:

Attachments:

- ☐ **Copy of Field Book Pages**
- ☐ **Copy of Chain-of-Custody**
- ☐ **Photographs**
- ☐ **Other**

Signature:

Department of Environmental Protection
Bureau of Remediation & Waste Management
RCRA Program

Standard Operating Procedure Change Record

Title: **DEVELOPMENT OF A SAMPLING AND ANALYSIS PLAN**

Identification #: DR014

SOP Originator: Brian Beneski

Author	Revision	Description of Change	Date
Deb Stahler	RCRA 01	Substitute MEDEP/RCRA in the place of MEDEP/DR, and Division of Oil and Hazardous Materials in the place of Division of Remediation. Section 2.0 Introduction: Change first sentence to "MEDEP/RCRA is responsible for the investigation and subsequent corrective actions for RCRA facilities throughout Maine."	5/31/02

Approved by:

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Scott Whittier, RCRA Program Director Date:

DEVELOPMENT OF A SAMPLING AND ANALYSIS PLAN

Maine Department of Environmental Protection

Division of Site Remediation

Standard Operating Procedure: **DR#014**
REVISION: **#1**
DATE: **January 25, 1999**
Written/Revised by: Brian Beneski
Reviewed by: Jean Firth

1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Remediation's (MEDEP/DR) procedure for developing a Sampling and Analysis Plan (SAP).

2.0 INTRODUCTION

MEDEP/DR is responsible for the investigation and remediation of uncontrolled hazardous substance sites throughout Maine. Prior to conducting investigative field work, a SAP is developed that outlines the goals of the activity and methodology to achieve that goal. With the phrase "Never start a vast project from half vast ideas" in mind, a well developed SAP that is reviewed by all field activity team members should assure that the goals are obtainable, the methodology is consistant, and the data generated will meet the Data Quality Objectives (DQOs) for the project.

3.0 RESPONSIBILITIES

All MEDEP/DR staff will follow the procedures outlined in this SOP for the development of a SAP. The project manager for a site is generally responsible for the development of the SAP, with input as appropriate from the field staff (MEDEP OHMS and MEDEP/Division of Technical Support (MEDEP/TS) Geologists). Their respective supervisors and managers are responsible for ensuring that they are familiar with and adhere to this procedure, and receive the appropriate training and guidance for developing SAPs.

4.0 GUIDELINES

An SAP will, at a minimum, contain the following elements.

4.1 Assessment of Existing Data

The project manager for the site will review any existing information on the site. Analytical data will be analyzed for completeness, quality and usability.

4.1.1 Site Reconnaissance

Prior to sampling events, particularly large multi - day events or multi media events, it is recommended that a site

reconnaissance be conducted to work out any logistical problems that may arise during sampling. This would include site access issues, physical impediments to sampling, access issues with surface water sampling, etc. Any logistical issues discovered during the site reconnaissance should be mentioned in the SAP along with recommendations for overcoming these issues.

4.1.2 Specific Requirements for USEPA Pre - Remedial Site Assessment

For federal site assessment reports (PAs, SIs, SIPs, ESIs and HRS) if scoresheets are available from a previous site assessment report, these will be reviewed. The goal in reviewing the score sheets is to identify outstanding data needs (data gaps) for accurately assess the site. If no scoresheets are available, the project manager will complete SI scoresheets for the site. Information that is available will be used. If information is unavailable, the most conservative assumption in each scenario will be used.

Specific attention will be paid to pathways which score greater than 57. If data is incomplete for these pathways the sampling plan should focus on collecting samples which will clarify, confirm or disprove previous assumptions.

4.2 Title Section

The title section of an SAP will contain the name and town of project, the name and title of the person developing the SAP, and the expected date of the field work and field personnel.

4.3 Introduction

The introduction will state:
-- Goals of the sampling plan
-- End use of data

4.4 Background Information

A brief explanation of the background of the Site will be presented.

4.4.1 Specific Background Requirements for Pre - Remedial Site Assessment Activities

For pre - remedial site assessment activities, a pathway analysis will be included in the SAP. Included in this analysis will be a discussion regarding the rationale for sampling or not sampling specific pathways and/or media.

4.5 Site Specific Health and Safety Plan

A Site Specific Health and Safety plan (HASP) will be developed and included with the SAP. The standard MEDEP/DR HASP form, which contains the minimum requirements for a HASP, can be found as Attachment A.

If below grade sampling is part of the SAP, Dig - Safe (1-800-225-4977) must be notified at least 3 working days prior to the sampling event.

4.6 Sampling Methodology/Equipment

A description of the sampling methodology will be included in the SAP. In instances were a MEDEP/DR Standard Operating Procedures are available, reference to these procedures by either name or document number is sufficient. Also included will be an equipment checklist; a copy of the MEDEP/DR standard check list can be found in attachment B. This checklist will be used for loading equipment in preparation of the sampling event.

4.7 Samples and Parameters

4.7.1 Sample Locations

A map showing planned sampling locations shall be included in the sampling plan. If locations are not pre - determined, the method that samples will be chosen and collected (field observations, random, etc.) will be outlined in the SAP. Also outlined will be any composite procedures, if applicable.

This section should also indicate sampling collection priority and order, to assure that the most important samples are obtained, and that sampling is generally done from low areas of contamination to higher levels of contamination. It is recommended that critical samples be collected in duplicate.

4.7.2 Media Sampled

A chart outlining the media collected and sample analysis will be included in the SAP. Generally, the media sampled will be:
-- Soil;
-- groundwater (via monitoring wells and residential wells);
-- Surface Water;
-- Sediment; and
-- Neat waste material.

4.7.3 Analytical Parameters

Parameters will be identified by either laboratory analysis methodology number, or generally accepted name of analysis.

Containers, preservation, and holding times will be as recommended by the laboratory providing analytical services. In most cases, the laboratory MEDEP/DR will be using is the Maine Health and Environmental Laboratory. A copy of current containerization, preservation, and holding time protocol can be seen in Attachment C.

4.8 Field QC Samples

The specific needs for QC samples for the project will be outlined; including, but not limited to:
-- background samples;
-- Replicates;
-- Trip blanks; and
-- Equipment blanks

4.9 Report Generation

A Sampling Event Trip Report (SETR) will be developed for every sampling event (See MEDEP/DR SOP DR#013). Staff person responsible for developing the SETR will be stated in the SAP.

5.0 ACRONMYMS

-- MEDEP/DR - Maine Department of Environmental Protection, Division of Remediation
-- MEDEP/TS - Maine Department of Environmental Protection, Division of Technical Services
-- SAP - Sampling and Analysis Plan
-- DQO - Data Quality Objectives
-- USEPA - United States Environmental Protection Agency Region I
-- PA - Preliminary Assessment

Department of Environmental Protection
Bureau of Remediation & Waste Management
RCRA Program

Standard Operating Procedure Change Record

Title: **PROTOCOL FOR COLLECTING DATA USING A FIELD PORTABLE X-RAY FLUORESCENCE SPECTROMETER FOR CERTAIN METALS IN SOLID MEDIA**

Identification #: DR015

SOP Originator: Brian Beneski

Author	Revision	Description of Change	Date
Deb Stahler	RCRA 01	Substitute MEDEP/RCRA in the place of MEDEP/DR, and Division of Oil and Hazardous Materials in the place of Division of Remediation. Section 2.0 Introduction: Change first sentence to "MEDEP/RCRA is responsible for the investigation and subsequent corrective actions for RCRA facilities throughout Maine."	5/31/02

Approved by:

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Scott Whittier, RCRA Program Director Date:

-- SI - Site Inspection
-- SIP - Site Inspection Prioritization
-- ESI - Expanded Site Inspection
-- HRS - Hazard Ranking Score
-- HASP - Health and Safety Plan
-- SETR - Sampling Event Trip Report

PROTOCOL FOR COLLECTING DATA USING A FIELD PORTABLE X-RAY FLUORESCENCE SPECTROMETER FOR CERTAIN METALS IN SOLID MEDIA

Maine Department of Environmental Protection
Division of Remediation

Standard Operating Procedure: **DR#015**
Revision: **1**
Date: **July 26, 2001**
Written by: **Jean Firth**
Reviewed by: **Gordon Fuller**

1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Remediation's (MEDEP/DR) procedure for collecting data using a portable x-ray fluorescence spectrometer (XRF) for certain metals in solid media.

2.0 INTRODUCTION

MEDEP/DR is responsible for the investigation and remediation of uncontrolled hazardous substance sites throughout Maine. In the course of the investigation and subsequent remediation, samples must be taken to determine the geographical extent, chemical characteristics, and relative levels of contaminants at each site and surrounding area. This standard operating procedure (SOP) is designed to be a guideline for data collection with a Niton XL-722S XRF for solid media (e.g. soil, sediment and sludge). This is a field screening method used for: profiling an area, locating sources of contamination, determining the horizontal or vertical extent of contamination or collecting preliminary data that will be used to design a sampling plan. Samples can be analyzed either in-situ methods or by intrusive sample preparation methods. This SOP will outline collecting data using both methods.

3.0 RESPONSIBILITIES

All Uncontrolled Sites Program Staff must follow this procedure when using the XRF. All managers and supervisors within MEDEP/DR are responsible for ensuring that their staff are familiar with and adhere to this procedure. *Additionally, before any person is allowed to use the XRF they* ***MUST:*** *have completed a radiation training course (proof of completion must be submitted to the DR Site Assessment and Support Services Unit (SASS)), wear a radiation dosimeter badge and have 2 days of supervised field use (within the last 6 months) by approved DR or Division of Technical Services staff*. Currently approved supervisors and users are listed in Attachment A. The DR Radiation Safety Coordinator is responsible for updating the list of supervisors and users.

4.0 PREPARATION AND GENERAL INFORMATION

4.1 Preparation

Prior to conducting any sampling event, a sampling plan should be developed (see SOP DR#014 - Development of a Sampling and Analysis Plan). Clean containers must be used for each sampling event unless in-situ sampling is to be perfomed.

An evaluation of the site the and the elements of concern should be made prior to using the XRF on a site. Determine if the XRF can analyze for the elements of concern and if the detection limits are acceptable to meet the Data Quality Objectives for the project.

Before sampling, a decision must be made whether to test the material:

- in-situ (in-place),
- as bagged samples (or for sludge, in cups) with a minimum of preparation, or
- in an XRF cup after preparation as described in Section 5.4.

If the primary objective of the sampling event is to determine whether an element is present (rather than in accurately measuring how much is present), in-situ or bagged samples are the quickest, simplest way to proceed. (Note: Preparing a sample by drying, milling and sieving will yield greater accuracy.) Even if the objective is to collect samples and prepare them prior to analysis, preliminary direct measurements can help to survey the site.

4.2 Equipment

Equipment required for this SOP may include:

-- **XRF** - Niton XL-722S X-Ray Fluorescence Spectrum Analyzer

a) XRF
b) Battery packs and charger
c) Test guard
d) Sample platform
e) Standards
f) Optical pen
g) Grinder
h) Mortar and pestle
i) various size sieves

-- **Sampling implements** - This includes shovels, Geoprobe® soil boring system, dredges, etc, as outlined in the site specific sampling plan. Please refer to the following MEDEP/DR SOPs for using this equipment:
    -- DR#004 - Sampling Surface Water and Sediment
    -- DR#006 - Soil Sampling
    -- DR#007 - Soil Sampling with a Geoprobe Large Bore Sampler

-- **Sample containers** – Whirl pack bags, zipper locking bags or sample cups.

-- **Radiation dosimeter** – must be worn by anyone using the XRF.

4.3 General Information

4.3.1 Radiation Sources

The DR's XRF contains 2 radiation sources Cd_{109} and Am_{241}. The Cd source detects the following elements: Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Pb, Hg, Rb, Sr, Zr, and Mo. The Am source detects the following elements: Cd, Ag, Ba, Sn, and Sb. To analyze for all of the elements listed above two readings with the XRF must be performed, one with each source.

4.3.2 Radiation License and Training Requirements

The DR's XRF is licensed through the Department of Human Services Radiation Control Program. The DR's XRF is listed on the DHS's Lead Prevention Program's license. This license is located at the Division of Solid Waste's Asbestos and Lead Unit's Radiation Safety Coordinators desk. Further information regarding the radiation license and its requirements are also located with the license. Only staff who have completed radiation training and are issued a radiation dosimeter badge may use the XRF. Additionally, staff using the XRF must have 2 days of supervised field use (within the last 6 months) by approved DR or Division of Technical Services staff. Currently approved supervisors and users are listed in Attachment A.

4.3.3 Detection Limits

An element will only be shown as detected by the XRF if the measured concentration of the sample is at least three times the standard deviation of the measurement. This detection limit will depend on the composition of the sample.

Detection limits depend on several factors, the analyte of interest, the type of excitation source, the strength of the excitation source, count times used to irradiate the sample, physical matrix effects, chemical matrix effects, and interelement spectral interferences. For more of an explanation of detection limits see Attachment 2 "EPA Method 6200". Detected elements are displayed as in the Measurement screen. Non-detected elements are shown as **< xx**, where **xx** is the detection limit for that sample. The detection limit for each element is calculated from each sample.

4.3.4 Interferences

Physical matrix interferences result from variations in the physical character of the sample. These variations may include such parameters as particle size, uniformity, homogeneity, and surface condition.

Moisture content may affect the accuracy of analysis of soil and sediment sample analyses. When the moisture content is between 5 and 20 percent, the overall error from moisture may be minimal. However, moisture content may be a major source of error when analyzing samples of surface soil or sediment that are saturated with water. This error can be minimized by drying the samples in a convection or toaster oven.

Inconsistent positioning of samples in front of the probe window is a potential source of error because the x-ray signal decreases as the distance from the radioactive source increases. This error is minimized by maintaining the same distance between the window and each sample. For the best results, the window of the probe should be in direct contact with the sample, which means that the sample should be flat and smooth to provide a good contact surface.

Chemical matrix effects result from differences in the concentrations of interfering elements. These effects occur as either spectral interferences (peak overlaps) or as x-ray absorption and enhancement phenomena.

When present in a sample, certain x-ray lines from different elements can be very close in energy and, therefore, can cause interference by producing a severely overlapped spectrum.

Ambient temperature changes can affect the gain of the amplifiers producing instrument drift. Gain or drift is primarily a function of the electronics (amplifier or preamplifier) and not the detector as most instrument detectors are cooled to a constant temperature. Most XRF instruments have a built-in automatic gain control. If the automatic gain control is allowed to make periodic adjustments, the instrument will compensate for the influence of temperature changes on its energy scale. If the XRF instrument has an automatic gain control function, the operator will not have to adjust the instrument's gain unless an error message appears. If an error message appears, the operator should follow the manufacturer's procedures for troubleshooting the problem. Often, this involves performing a new energy calibration.

4.3.5 Precision

The measurement precision for each element displayed appears to the right of the measured concentration, under the heading "+-". The **precision** of each measurement is two times the standard deviation (sigma). An element is classified **detected** if the measured concentration (in ppm) is at least 1.5 times the precision.

4.3.6 Maintenance

If there are any problems with how the XRF is working, stop using the instrument and report the problem to the DR's SASS. **Do not attempt to fix the XRF yourself.** Opening the instrument may expose the user to the radiation source and will void the warrantee.

4.4 Procedure for Operating the Niton XL-722S XRF

Refer to the attached Niton Users Guide for additional information and figures showing the features of the instrument (Attachment B).

4.4.1 To turn on the XRF depress and slide the *On/Off* switch on the bottom of the instrument to the on position. If the instrument does not turn on immediately, turn it off, wait a few seconds and turn it on again. The Main menu should appear.

If the optical pen is going to be used, this needs to be attached prior to turning the XRF on.

4.4.2 There are three buttons on the control panel that are used to navigate through all of the XRF screens and menus. To select a function press the Clear/Enter button for the function indicated on the screen with an arrow. When the instrument is turned on the arrow will point to *Calibrate & Test*. Leave the instrument on for at least 15 minutes prior to using to allow the XRF to warm up and equilibrate to the surrounding environment.

4.4.3 From the main menu select *Setup Menu* from here the sample mode can be selected. The DR's Niton XL-722S is only capable of analyzing in *Test Soil, Bulk Samples*. The XRF will automatically be set to the last mode used, so this should not have to be changed.

Other functions that are accessed from this menu include: setting the date and time, checking the strength of the sources, illuminating the screen and viewing the instrument specifications. For further information on using these functions, refer to Attachment 1.

THE DATE AND TIME MUST BE CORRECT BEFORE USING THE XRF.

Select *Exit to Main Menu* to return to the *Main Menu.*

4.4.4 Select *Calibrate & Test* and press Clear/Enter to begin the self calibration. After the XRF beeps, the calibration is complete and the instrument is ready for use.

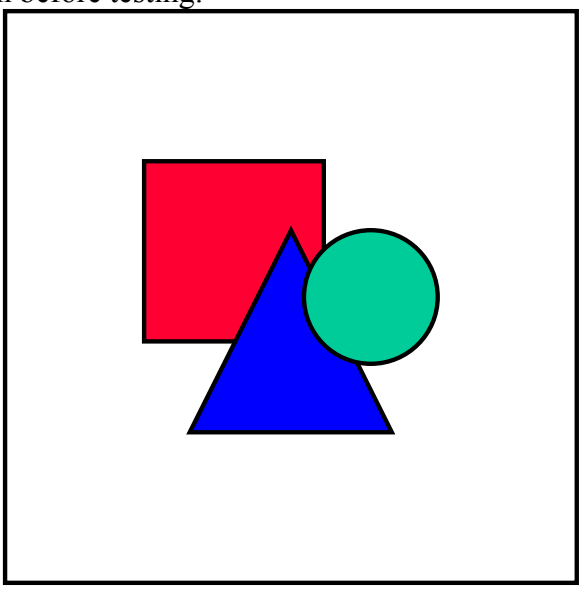
Check the XRF's calibration with testing standards before using the XRF to analyze samples, using standards that are closest to the levels of elements that are expected onsite. Recheck the standards at least once per hour during testing and after analysis has been completed for the day.

5.0 SAMPLING AND ANALYSIS PROCEDURE

EPA Method 6200 Field Portable X-Ray Fluorescence spectrometry for the determination of elemental concentrations in soil and sediment (Attachment C) provides additional information regarding acceptable testing procedures and may be used in place of the procedure described below.

5.1 In-situ Analysis

5.1.1 Clear the area selected for analysis of any surface debris or vegetation. Level the area so the XRF will contact the area evenly. Keep in mind that a finer and more homogeneous material will yield more accurate the results. Increased accuracy can be obtained by loosening the soil and letting it dry in the sun before testing.



5.1.2 Place the test guard on ground being careful to keep the top of the test guard clean.

5.1.3 Hold the XRF in one hand keeping your hand behind the end plate. Make sure there are no people (including yourself) in the pathway of the radiation source.

Warning: Always treat radiation with respect. Do not put your hand on the end plate of the NITON while measuring. Never point the NITON at yourself or anyone else when the shutter is open.

5.1.4 Push the safety slide out from under the shutter release. If the slide is still engaged the shutter release will not depress and the instrument will not fit on the test guard correctly.

5.1.5 Place the XRF on the test guard so that the rectangular opening on the test guard is under the window of the XRF, squeeze the shutter release, and firmly press the instrument flat against the surface of the test guard. If the shutter release is not completely pressed, the plunger will not

depress. If the plunger is not fully depressed, the window is not fully open and the XRF cannot measure accurately. The back of the unit must be flush with the test guard. The shutter release does not need to be held continuously during the measurement. Hold the XRF tightly against the test guard to maintain the reading. Once the XRF is lifted the plunger will fall back and the shutter will close; this will end the reading. In the event that the plunger sticks in the open position simply push it down. If problems persist stop using the instrument and report any problems to the DR's SASS.

5.1.6 Watch the display screen results to decide when the test has reached the desired level of accuracy. A typical screening test will last 30-60 *source* seconds.

5.2 In-situ depth profiling

An in-situ XRF soil test examines only the top millimeter or so of soil. To profile the depth of contamination, remove a vertical slice of soil and test several samples from different depths.

5.3 Analysis of Bagged Solid Samples

Sometimes it is convenient for screening a site to collect samples in plastic bags and analyze them without preparation. Because samples are tested through a bag, test results will tend to be 5-10% lower than test results obtained from direct analysis.

5.3.1 Place 50-100 grams of sample in a clean whirl pack or zipper locking bag. Remove any large stones or debris. Keep in mind that finer and more homogeneous material will yield more accurate results. Increased accuracy can be obtained by letting the sample dry in the sun before testing. Mix the sample thoroughly by kneading the bag.

The accuracy of measurements will be limited by the thickness of the plastic in the bag used. 1 mil-thick polyethylene bags offer a reasonable compromise between accurate readings and bag durability.

5.3.2 Flatten the bag of soil to form a continuous uniform layer of at least 1 cm. (0.4 inch) thickness. Place the NITON test guard flat against the bag. **Do not hold bagged samples in your hand during testing.**

5.3.3 Hold the XRF in one hand keeping your hand behind the end plate. Make sure there are no people (including yourself) in the pathway of the radiation source.

Warning: Always treat radiation with respect. Do not put your hand on the end plate of the NITON while measuring. Never point the NITON at yourself or anyone else when the shutter is open.

5.3.4 Push the safety slide out from under the shutter release. If the slide is still engaged the shutter release will not depress and the instrument will not fit on the test guard correctly.

5.3.5 Place the XRF on the test guard so that the rectangular opening on the test guard is under the window of the XRF, squeeze the shutter release, and firmly press the instrument flat against the surface of the test guard. If the shutter release is not completely pressed, the plunger will not depress. If the plunger is not fully depressed, the window is not fully open and the XRF cannot measure accurately. The back of the unit must be flush with the test guard. The shutter release does not need to be held continuously during the measurement. Hold the XRF tightly against the test guard to maintain the reading. Once the XRF is lifted the plunger will fall back and the shutter will close this will end the reading. In the event that the plunger sticks in the open position simply push it down. If problems persist stop using the instrument and report any problems to the DR's SASS.

5.3.6 Watch the display screen results to decide when the test has reached the desired level of accuracy. A typical screening test will last 30-60 *source* seconds.

5.4 Analysis of Prepared Samples

Prepared sample analysis is the most accurate method for determining the concentration of elements in a solid media. Sample preparation minimizes the effects of moisture, large particle size and variations in particle size.

NITON recommends a specific sample protocol. Following this protocol for preparing and testing samples is vital for achieving a level of accuracy comparable with laboratory results. See Attachment B Figure 3.06 for a flow chart of the protocol. The following method is a slight modification of that method.

5.4.1 Collect 50-100 grams of sample to insure that there is enough sample to be representative and unbiased after mixing, grinding, and sieving it.

5.4.2 Place the sample in a clean bowl and mix the sample thoroughly by stirring and by rotating the bowl. Gently break up any dirt clods. Don't shake the sample because the sample may become stratified by weight.

5.4.3 If the sample is moist it should be dried. To best prepare a sample for analysis the material should be dry and well homogenized. Ideally, the entire sample should be dried to constant weight, sieved to remove gravel and debris, and ground or milled to a fine powder.

The sample can be dried in several ways:

- Oven dry the sample for approximately 2 hours at 150° C., until the sample reaches a constant weight;
- air dry the sample overnight at room temperature in a shallow pan;
- gently stir and warm the sample in a pan over a hot plate or burner.

Oven, hot plate or burner drying is inappropriate when volatile compounds may be present in the sample. For example, lead present as tetraethyl lead would be driven off by the heat of drying. Some forms of mercury and arsenic are volatile. If mercury is to be analyzed the sample must be air dried.

5.4.4 Sieve the dried sample with the #10 (2mm) mesh and separate out the larger pieces (stones, organic matter, metallic objects).

5.4.5 Grind the sample with a mortar and pestle or electric grinder the soil particles are finer and more homogenous.

5.4.6 Sieve at least 10 grams of the sample through #60 (250 um) and #120 (125 um) mesh. Re-grind the unpassed material until the required fraction is able to pass. Mix the resulting sample.

5.4.7 Place the sample in a sample cup. To assemble a sample cup: *1)* place a circle of mylar film on top of an XRF sample cup. The window goes on the end of the cup with the indented ring. *2)* Secure the film with the collar. The flange inside the collar faces down and snaps into the indented ring of the cup. Inspect the installed film window for continuity and smooth, taut appearance. *3)* Set the cup, window-side down, on a flat surface. Fill it with at least three grams of the prepared sample (no more than half-full). Take care that there are no voids or layering. *4)* Placing the cup film-side down on a flat surface, tamp the sample into the cup. *5)* Fill the cup with polyester fiber stuffing to prevent sample movement. Use aquarium filter or pillow filling as stuffing. A small supply of stuffing comes with the bulk sample kit. *6)* Fasten the cap on the cup.

5.4.8 Place the sample cup in the receptacle of the sample test platform. Included in the kit are some foam disks that can be put in the receptacle under the cup for firmer contact between the XRF and the sample cup window. Attach the XRF to the test stand. Make sure there are no people (including yourself) in the pathway of the radiation source.

Warning: <u>Always</u> treat radiation with respect. Do not put your hand on the end plate of the NITON while measuring. Never point the NITON at yourself or anyone else when the shutter is open.

5.4.9 Push the safety slide out from under the shutter release. If the slide is still engaged you cannot press in the shutter release and the instrument will not fit on the test platform correctly.

5.4.10 Place the XRF on the test platform so that the window of the XRF is over the sample cup, squeeze the shutter release, and firmly press the instrument flat against the surface of the test guard. If the shutter release is not completely pressed, the plunger will not depress. If the plunger is not fully depressed, the window is not fully open and the XRF cannot measure accurately. The back of the unit must be flush with the test guard. The shutter release does not need to be held continuously during the measurement. Hold the XRF tightly against the test guard to maintain the reading. Once the XRF is lifted the plunger will fall back and the shutter

will close; this will end the reading. In the event that the plunger sticks in the open position simply push it down. If problems persist stop using the instrument and report any problems to the DR's SASS.

5.4.11 Watch the display screen results to decide when the test has reached the desired level of accuracy. A typical screening test will last 30-60 *source* seconds.

5.5 Downloading Data from the XRF

5.5.1 Downloading Data

The DR's XRF stores up to 1,000 measurements plus their spectra. This can be downloaded to a computer for reporting or insertion in a database.

Note: Downloading data does not erase readings. To make room for the next set of data, erase readings after verifying that the data was downloaded successfully (see next section).

See Attachment B for directions on downloading data.

5.5.2 Erasing readings

If you do not erase your data, the NITON will continue to record data until the memory is completely full. Then the NITON will start to overwrite older data. Any data that is overwritten in this way will be lost. Download your data before the memory is completely full. Clear the memory after downloading.

6.0 DECONTAMINATION

Decontamination of equipment will follow the MEDEP DR SOP DR#017 - "Decontamination Procedures Protocol". Additionally the following methods may be used in the field:

The mortar, pestle, and grinding mill may be cleaned with dry paper towels. Water will also clean the mortar, pestle, and the mill's container, but be sure each is absolutely dry before they are used for another sample. The mortar and pestle may be cleansed by grinding clean dry sand in the mortar. Use the short bristle brushes (included in the Bulk Testing Kit) to clean the sieves.

7.0 CHAIN OF CUSTODY

For confirmatory samples that are submitted to a fixed laboratory, procedures for chain of custody outlined in MEDEP/DR SOP DR#012 - "Chain of Custody" must be followed.

8.0 DOCUMENTATION

All sampling activities must be documented as outlined in MEDEP/DR SOP DR#013 – "Documentation of Field Notes and Development of a Sampling Event Trip Report". Each sample location will be given a unique sample number. This number will be entered into the XRF with the optical pen and or recorded in the field notes. If no number is entered into the XRF, the default number shown on the XRF screen for that sample will be recorded in the field notes.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

9.1 Quality Assurance Samples

Depending on the DQO's for a project the following QA samples may be collected. Any QA sample analyzed will be documented in field notes or in a written report. Calculations for QA samples will also be documented and if QA samples are re analyzed the results of will be documented.

9.1.1 Energy Calibration Check: To determine whether the XRF is operating within resolution and stability tolerances, an energy calibration check should be run. The energy calibration check determines whether the characteristic x-ray lines are shifting, which would indicate drift within the instrument. This check also serves as a gain check in the event that ambient temperatures are fluctuating greatly (> 10 to 20deg.F). Generally, this is run at the beginning of each working day, after the batteries are changed or the instrument is shut off, at the end of each working day, and at any other time when the instrument operator believes that drift is occurring during analysis.

9.1.2 Blank Samples: Two types of blank samples should be analyzed for XRF analysis: instrument blanks and method blanks. An instrument blank is used to verify that no contamination exists in the spectrometer or on the probe window.

9.1.2.1 The instrument blank can be silicon dioxide, a Teflon block, a quartz block, "clean" sand, or lithium carbonate. This instrument blank should be analyzed on each working day before and after analyses are conducted and once per every twenty samples. An instrument blank should also be analyzed whenever contamination is suspected by the analyst. The frequency of analysis will vary with the data quality objectives of the project.

9.1.2.2 A method blank is used to monitor for laboratory-induced contaminants or interferences. The method blank can be "clean" silica sand or lithium carbonate that undergoes the same preparation procedure as the samples. A method blank must be analyzed at least daily. The frequency of analysis will depend on the data quality objectives of the project. To be acceptable, a method blank must not contain any analyte at a concentration above its method detection limit. If an analyte's concentration exceeds its method detection limit, the cause of the problem must be identified, and all samples analyzed with the method blank must be reanalyzed.

9.1.3 Calibration Verification Checks: A calibration verification check sample is used to check the accuracy of the instrument and to assess the stability and consistency of the analysis for the

analytes of interest. A check sample should be analyzed at the beginning of each working day, during active sample analyses, and at the end of each working day. The frequency of calibration checks during active analysis will depend on the data quality objectives of the project. The check samples used by the DR will be NIST or other SRM that contains the analytes of interest. These will verify the accuracy of the instrument. The measured value for each target analyte should be within +/-20 percent (%D) of the true value for the calibration verification check to be acceptable. If a measured value falls outside this range, then the check sample should be reanalyzed. If the value continues to fall outside the acceptance range, the instrument should be re-calibrated, and the batch of samples analyzed before the unacceptable calibration verification check must be reanalyzed.

9.1.4 Precision Measurements: The precision of the method is monitored by analyzing a sample with low, moderate, or high concentrations of target analytes. The frequency of precision measurements will depend on the data quality objectives for the data. A minimum of one precision sample should be run per day. Each precision sample should be analyzed 7 times in replicate. It is recommended that precision measurements be obtained for samples with varying concentration ranges to assess the effect of concentration on method precision. A precision sample is analyzed by the instrument for the same field analysis time as used for other project samples. The relative standard deviation (RSD) of the sample mean is used to assess method precision. For FPXRF data to be considered adequately precise, the RSD should not be greater than 20 percent with the exception of chromium. RSD values for chromium should not be greater than 30 percent.

The equation for calculating RSD is as follows: RSD = (SD/Mean Concentration) x 100
where: RSD = Relative standard deviation for the precision measurement for the analyte
SD = Standard deviation of the concentration for the analyte, Mean Concentration = Mean concentration for the analyte.

9.1.5 Confirmatory Samples: The comparability of the XRF analysis is determined by submitting XRF-analyzed samples for analysis at a laboratory. The method of confirmatory analysis must meet the project and XRF measurement data quality objectives. The confirmatory samples must be splits of the well homogenized sample material. In some cases the prepared sample cups can be submitted. A minimum of 1 sample for each 20 XRF-analyzed samples should be submitted for confirmatory analysis. This frequency will depend on data quality objectives. The confirmatory analyses can also be used to verify the quality of the XRF data. The confirmatory samples should be selected from the lower, middle, and upper range of concentrations measured by the XRF. They should also include samples with analyte concentrations at or near the site action levels. Acceptance criteria for comparison of field and lab samples will be 20% difference of sample results or stated in the site specific QAPP or sampling plan. If the acceptance criteria is exceeded the project manager will evaluate the results to determine if they meet the data quality objectives for the project. If the data quality objectives are not met samples will be re-run or collected again for analysis.

9.2 Deviations from SOPs

All deviations from the procedures outlined in this or in any other SOPs followed for XRF sampling must be documented in field notes.

10.0 REFERENCES

NTION Corporation XL-309 & 700 Series Users Guide Version 5.0 (HTML). 1993, 1994, 1995, 1996, 1997, 1998.

EPA Method 6200 Field Portable X-Ray Fluorescence Spectrometry For the Determination of Elemental Concentrations in Soil and Sediment.

Attachment A

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Standard Operating Procedure Change Record

Title: **REQUIREMENTS FOR THE DEVELOPMENT OF A SITE SPECIFIC QUALITY ASSURANCE PROJECT PLAN**

Identification #: DR016

SOP Originator: Brian Beneski

Author	Revision	Description of Change	Date
Deb Stahler	RCRA 01	Substitute MEDEP/RCRA in the place of MEDEP/DR, and Division of Oil and Hazardous Materials in the place of Division of Remediation. Section 2.0 Introduction: Change first sentence to "MEDEP/RCRA is responsible for the investigation and subsequent corrective actions for RCRA facilities throughout Maine."	5/31/02

Approved by:

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Scott Whittier, RCRA Program Director Date:

REQUIREMENTS FOR THE DEVELOPMENT OF A SITE SPECIFIC QUALITY ASSURANCE PROJECT PLAN

Maine Department of Environmental Protection

Division of Remediation

Standard Operating Procedure: **DR#016**
REVISION: **#1**
DATE: **May 14, 1999**
Written/Revised by: Brian Beneski
Reviewed by: Steve DiMattei, USEPA

1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and waste management, Division of Remediation (MEDEP/DR) procedure for developing a Site Specific Quality Assurance Project Plan (QAPP) for site activities where a QAPP is deemed necessary.

2.0 INTRODUCTION

This procedure outlines the minimum specific requirements that must be included in a QAPP. It is intended to assure that the data generated will meet the Data Quality Objectives that are required (and identified in the QAPP) for a specific project and/or site.

A QAPP will be generated for field work conducted specifically for an HRS. Additionally, a QAPP may be generated for a specific site if the QAC, the MEDEP/DR project manager and supervisor, and the appropriate project personnel at USEPA Region I determine one is necessary. Examples in which a site specific QAPP may be generated would a Site which is will in all likelihood be listed on the National Priority List (NPL), or a site in which there is a possibility of litigation.

3.0 RESPONSIBILITIES

All MEDEP/DR staff must follow this procedure when drafting a QAPP. The project manager for the site is responsible for drafting the QAPP. The Quality Assurance Coordinator (QAC) and/or Quality Assurance Manager (QAM) will review and provide comments to the QAPP as necessary to assure that the requirements for a QAPP are met and assure consistency between QAPPs generated by MEDEP/DR. Appropriate peer review from USEPA Region is also required.

4.0 GUIDELINES

Prior to developing a QAPP MEDEP/DR staff will develop Data Quality Objectives as described in the QAP section 5.0.

A QAPP must have the following elements.

4.1 Title page

The following elements shall be included on the title page: title of plan, site name, program authority, and name of organization implementing the plan. Additionally, include names, titles and signatures of staff completing the QAPP and any approving officials, including dated signed.

4.2 Table of Contents

This section should list all sections, figures, tables, references and appendices, along with page numbers indicating location of each.

4.3 Introduction

4.3.1 Project Organization

The Project Organization must identify data generators, data-users and decision makers, as well as specific organizations, job categories, and job responsibilities. Also authorities associated with the QAPP relationship between organizations, and lines of communication should be defined.

4.3.2 Project Goal and Data Use

The goal of the project and the end use of the data as described in the DQO section of the QAP will be stated in the introduction. The regulatory or exposure situation that determined the need for the project will be described in this section.

4.4 Background

This section will include historical and background information.

4.5 Project Description

An identification of all measurements proposed, including physical measurements and characteristics, chemical analyses, and a schedule for performance of the activities will be contained in this portion of the document.

4.7 Sampling Process Design (Experimental Design)

This section will present the rationale for sampling design. Sampling design can include the elements of sample location, sample matrices, measurement parameters, geographical spacing, sampling methods and equipment, monitoring device design and installation (e.g. Monitoring wells), sampling intervals (vertical, horizontal and time), sample documentation, corrective action and schedule of work.

This section should provide the justification for the measurements and activities proposed in the project description to meet the project DQOs.

4.8 Sampling Methods Requirements

Standard Operating Procedures (SOPs) or site-specific procedures for performance of field sampling activities should be provided in this section (reference MEDEP/DR SOPs and/or USEPA procedures used for collecting samples).

Description of the sample collection devices and procedures for decontamination of equipment and materials should be outlined in this section.

4.9 Sample Handling and Custody Requirements

A description of the documentation, sample packaging, and shipping procedures will be contained in this section. All observations regarding sample location will be recorded in a field logbook or log sheets.

4.10 Analytical Method Requirements

The methods used to analyze both field and laboratory samples are cited or described in this section. In the case of laboratory methods a reference to the identification number and source of the method must be stated, the method itself need not be reproduced.

If several analyses are proposed, a table identifying each analysis for each sample location and medium is recommended.

4.11 QC Requirements

This section refers to both the number of QC samples that will be collected in the field and the QC samples analyzed in the Laboratory to allow data validation. Field QC samples such as field replicate and rinsate blanks are collected at a rate of 5 percent, or at least one per sampling event. The procedures indicated below in Sections 4.12 and 4.13 of this document are to be performed where appropriate.

4.12 Field QC

The sampling component of the QAPP shall include:

A. Procedures for documenting and justifying any field actions contrary to the QAPP;

B. Documentation of all pre-field activities such as equipment check-out, calibrations, and container storage and preparation;

C. Documentation of field measurement QC data;

D. Documentation of field activities;

E. Documentation of post-field activities including sample shipment and receipt, field team de-briefing and equipment check-in; and

F. Generation of QC samples including duplicate samples, field blanks, equipment blanks, and trip blanks. Table 2 shows the frequency and number of QC samples that should be collected during a sampling event.

4.13 Instrument Calibration and Frequency

A description of the calibration procedures and frequency for field instruments used must be included in this section. At a minimum, calibration procedures and frequency must meet the manufacturer's requirements. The manufacturer's instructions for calibration may be included as an attachment to the QAPP. Calibration of laboratory equipment used for sample analysis will be described in the laboratory SOPs. If the analytical method selected prescribes the calibration procedures and frequency, citation of the method number is adequate in the QAPP.

TABLE 1
Guidelines for Minimum QA/QC Samples
For Field Sampling Programs

Medium	**Replicates[3]**	**Field Blanks[2]**	**Trip Blanks[4]**	**Rinsate Blanks[3]**	**Background Samples**
Aqueous	One in twenty	As conditions necessitate.	One per shipping container with VOC samples	One per 20 decontamination procedures	Minimum of one per sampling event per medium
Soil, sediment	One in twenty	As conditions necessitate.	One per shipping container with VOC samples	One per 20 decontamination procedures	Minimum of one per sampling event per medium
Air	One in twenty		One per shipping container with VOC samples	One per decontamination procedures	Minimum of one per sampling event per medium
Source material	One in twenty	As conditions necessitate.		One per 20 decontamination procedures	

Notes: 1) QA/QC requirements on a site-specific basis may dictate a more stringent frequency. Laboratory blanks and spikes are method-specific and are not included in this table. However, as a minimum, 10% of laboratory analyses must be QC samples.

2) Field Blanks are required when background contamination of the breathing zone is detected. One should be collected from each different industrial or functional area sampled during the most active time of day.

3) Replicate and rinsate samples are collected at the minimum rate of 1 per 20 samples/decontamination procedures. If fewer than 20 samples are collected, one replicate and one rinsate sample must be collected.

4) Trip blanks are prepared in the laboratory or at another off-site location from de-ionized water. They are never prepared on-site, or from soils or other solid material.

4.14 Assessment and Response Actions

Assessments required for most projects include:

A. Management systems reviews;

B. Technical systems audits; and
C. Performance evaluation samples.

Reviews and audits are conducted periodically to check that activities described in the field QAPP and in the QA Program Plan have been appropriately conducted and documented.

In addition to describing the components of each type of review/audit, the section must describe how appropriate response actions for non-conformance will be addresses and documented, and who is responsible for implementing corrective actions The QACC or QAM may conduct management systems reviews or technical systems audits at any time during the course of a project.

4.15 Data Review, Validation and Verification Requirements

4.15.1 Data Review

This section should state the criteria used by the project manager to review and validate data; (i.e., accept, reject or qualify data). Additionally, the following questions should be answered: What recovery and other standards must the lab meet? How much precision and accuracy are desired/required of the analytical data to be acceptable? What percent of the data must be laboratory analytical data for it to be acceptable? The project DQOs should be considered when all data is reviewed.

4.15.2 Validation and Verification Methods

This section will describe how the data reviews identified above will be conducted. The equations for precision, accuracy and completeness are included in the general QAP, and equations for any other DQOs evaluations will be included in the QAPP.

This section should also describe how the data are handled if the described criteria are not met, and answer the following questions: At what point is the data rejected? At what point is it qualified? What types of qualifiers are applied? When is re-analysis by the lab required if the standards are not met? What are the consequences if adequate sample is not available, and/or holding times have been exceeded?

4.16 Reconciliation with DQOs

After each phase or major portion of a sampling event or project, the results must be compared with the quantitative and

qualitative DQOs and project objectives identified in the QAPP. Any limitations on the data, the usefulness of the data, and changes to DQOs as a result of any limitations must be addressed. Applicable uses of the data that have been qualified will be compared to the original uses desired (DQOs). Additional data collection activities may be required if the usability of the data is not satisfactory. This section should identify the criteria for determining that additional data collection is needed.

4.17 Distribution List

At a minimum, the following people will receive and/or review copies of a QAPP:

-- MEDEP/DR Site Project Manager
-- MEDEP/DR QAC
-- Site Geologist
-- Project Field Staff
-- Maine State Department of Human Services Health and Environmental Laboratory Project Manager
-- USEPA Project Manager

Anyone else determined necessary by the Site Project Manager, QAC, or USEPA Project Manager. A distribution list stating the names of persons receiving copies and/or reviewing the QAPP and their position will be included in the QAPP.

4.18 Specialized Training

Need for specialized training will be stated in the QAPP. Documentation of staff attending training will be placed in the project file upon completion of said training.

4.19 Documentation

All field notes will be kept as stated in MEDEP/DR SOP DR#013 - Documentation of Field Notes and Development of a Sampling Event Trip Report. Sample chain of Custody procedures for the project will be as stated in MEDEP/DR SOP DR#012 - Chain of Custody Protocol. Any variations or modifications to documentation procedure will be stated in the QAPP. All documentation will be placed in the Site file as a permanent repository, in accordance with Section 11.0 - Document Control, of the MEDEP/DR QAP.

4.20 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Equipment used for projects will be inspected, maintained, and calibrated, in accordance with manufacturer's instructions and/or as outlined in the MEDEP/DR protocol stated in Section 7.0 - Equipment of the MEDEP/DR QAP. Documentation of such activities will be in accordance with Section 7.0 of the MEDEP/DR QAP.

4.21 Inspection of Supplies and Consumables

A list of expected consumable supplies will be included in the QAPP. All consumable supplies will be inspected upon their receipt, and again prior to being taken into the field by field staff. Once inspected, the item on the list will be checked off with an "OK" indicating it has passed inspection. Any supplies that are determined not acceptable will not be used for the project. If it becomes necessary to use material that may not meet specifications, this shall be stated in the field notes of the person conducting the inspection.

4.22 Final Report(s)

A final report will be generated at the end of the project that will summarize the data generated during the project by the project manager. Included in this report will be a recommendation for additional work, and the appropriate entity to conduct the additional work. If no additional work is determined to be necessary, a "no further action" conclusion will be stated, with the rationale for such a conclusion.

5.0 ACRONYMS

-- MEDEP/DR - Maine Department of Environmental Protection's Division of Redemption
-- QAPP - Quality Assurance Project Plan
-- HRS - Hazard Ranking Score
-- QAC - Quality Assurance Coordinator
-- QAM - Quality Assurance Manager
-- USEPA - United States Environmental Protection Agency, Region I
-- DQO - Data Quality Objectives
-- SOP - Standard Operating Procedure
-- QC - Quality Control

Department of Environmental Protection
Bureau of Remediation & Waste Management
RCRA Program

Standard Operating Procedure Change Record

Title: **DECONTAMINATION PROCEDURES PROTOCOL**

Identification #: DR017

SOP Originator: Brian Beneski

Author	Revision	Description of Change	Date
Deb Stahler	RCRA 01	Substitute MEDEP/RCRA in the place of MEDEP/DR, and Division of Oil and Hazardous Materials in the place of Division of Remediation. Section 2.0 Introduction: Change first sentence to "MEDEP/RCRA is responsible for the investigation and subsequent corrective actions for RCRA facilities throughout Maine."	5/31/02

Approved by:

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Scott Whittier, RCRA Program Director Date:

DECONTAMINATION PROCEDURES PROTOCOL

Maine Department of Environmental Protection

Division of Remediation

Standard Operating Procedure: **DR#017**
REVISION: **#2**
DATE: **January 22, 1999**
Written/Revised by: Brian Beneski
Reviewed by: Gordon Fuller

1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division Remediation (MEDEP/DR) procedure for decontamination of equipment used at uncontrolled hazardous substance sites.

2.0 SCOPE

This procedure applies to all MEDEP/DR staff who are involved with field activities which require the decontamination of equipment. This procedure describes the different levels of decontamination and the specific steps to be followed at each level. This procedure is intended to ensure that field equipment is properly and adequately decontaminated in order to preserve the integrity of data collected with that equipment in the field as well as to protect staff working with the equipment from exposure to contaminants.

3.0 INTRODUCTION

MEDEP/DR is responsible for the investigation and remediation of uncontrolled hazardous substance sites throughout Maine. In the course of the investigation and subsequent remediation, both simple and sophisticated equipment are used to collect samples and gather data pertinent to identifying the characteristics of the site. This standard operating procedure(SOP) is a guideline for the decontamination of all equipment at uncontrolled hazardous substance sites. In addition to this guideline, personnel using a specific piece of equipment for the first time should also review the manufacturers user manual for any equipment specific decontamination procedures recommended by that manufacturer. All user manuals for equipment available to MEDEP/DR personnel are kept with the MEDEP/DR Oil and Hazardous Materials Specialists (OHMS), or with the MEDEP Division of Technical Services (MEDEP/TS) Geologist Technician.

Decontamination is an essential part of a successful field operation. Decontamination is useful and necessary for a variety of reasons. First, decontamination of equipment prolongs the usable life of the equipment; if a bailer is used to sample a well and then properly decontaminated, the bailer can be used in future sampling events at other wells. Decontamination also lessens the potential for cross-contamination of samples. If a hand auger is properly decontaminated after taking a soil sample, the next sample

taken with the auger should be a representative sample for that location. No cross-contamination from previous samples should have occurred. Lastly, proper decontamination of equipment reduces the likelihood of contamination leaving the site and threatening other areas with contamination.

4.0 RESPONSIBILITIES

All MEDEP/DR staff must follow this procedure when performing field activities requiring the decontamination of field equipment. All Managers and Supervisors are responsible for ensuring that their staff are familiar with and adhere to this procedure.

5.0 DEFINITIONS

-- Decontamination - Removing contamination through physical methods, chemical methods, or a combination of both.

-- Photoionization Detector (PID) - An instrument used to detect photoionizable gases in the atmosphere. Each PID has a probe with a lamp that produces a given amount of electron-volts (eV). Compounds with an ionization potential less than the eV value for the PID lamp may be ionized and concentrations quantified against a specific reference standard.

6.0 GUIDELINES/PROCEDURES

Decontamination generally involves three steps: 1) gross contamination removal; 2) field decontamination; 3) secondary decontamination.

6.1 Gross Contamination Removal

If a piece of equipment is grossly contaminated, use appropriate tools/equipment (for example, scraper, bristle brush, sponge, etc.) to remove the excess soil, sludge, and other obvious contamination. While removing the contamination, spray the items of equipment with water or a detergent/water solution. Such spraying (especially from a high pressure sprayer) may loosen the contamination with a minimal amount of effort. Remember that each item used for the decontamination of equipment may also become contaminated and must be appropriately handled, stored, and either decontaminated itself or disposed of. Also be aware that all of the above decontamination procedures should be completed with an appropriate level of personnel protection no more than one level below the level the fieldwork was completed in.

This means no less than level D which includes chemically resistant gloves, boots, overalls, etc.

In addition, the decontamination of equipment generates contaminated rinse liquids, sludges, etc., that potentially may need to be containerized onsite until proper disposal arrangements are made. In some instances, the levels of contamination may be sufficiently low and disposal at a hazardous waste facility may not be necessary. This decision will be made by field personnel on a site by site basis following consultation with the project manager.

Certain items that become grossly contaminated and cannot be practically decontaminated (i.e. small tools and tools with wooden handles) should be disposed of properly. In some instances it is more practical and sensible to dispose of these items properly than to attempt decontamination. Such decisions will be made by the field personnel performing the work activities at the site.

6.2 Field Decontamination

Once the gross contamination has been removed from a piece of equipment, a more thorough cleaning involving detergents (Liquinox® is the standard detergent of MEDEP/DR) and rinses should be done. Brushes, buckets, sponges, polyethylene bags and sheeting, detergent/water solutions, and tap or deionized water (as stated in Sampling and Analysis Plan; see SOP DR#014 - Development of a Sampling and Analysis Plan) are a few of the items necessary for general field decontamination.

The primary steps to take when performing field decontamination of equipment are dependent on what item of equipment is being decontaminated; however, these steps will generally be followed:

(1) disassemble the equipment (if applicable), and place in a bucket or suitable sized basin filled with a deionized or tap water and Liquinox® (or other appropriate detergent);
(2) Scrub the equipment thoroughly with a suitable sized brush;
(3) rinse the inside and outside of the equipment with deionized or tap water.

In some instances, an additional wash with methanol may be required. The need for a methanol solvent wash will be determined on a site by site basis after consultation with the OHMS and project manager prior to the sampling event. A methanol solvent wash may be necessary in the case of sampling in high levels of contamination, or when sampling particularly difficult to clean contamination such as coal tar. The need

for a methanol solvent wash will be stated in the individual site sampling plan developed for the site.

If the equipment is to be reused at another sampling point, an inspection should be made to assure that the equipment is cleaned. If any doubts exist that the equipment has not been thoroughly decontaminated, the item should be cleaned again, or not used. If the equipment is not to be used again, place the equipment in a polyethylene bag for transport from the field to the storage warehouse. Secondary decontamination will take place in the decontamination area of the equipment storage building.

Instruments such as pH meters, conductivity meters, and other instruments which are immersed in a medium also need field decontamination. In many cases, these instruments do not come into contact with the actual "material" that will be collected for analysis. An example would be collection of groundwater samples using "low flow" methodology (Low flow methodology is outlined in SOP DR#003). In instances such as this, a thorough rinsing of the instrument probes would suffice, with secondary decontamination (see section 6.3 below) to follow after the sampling event, when greater care can be taken so the instrument is not damaged.

If the equipment to be decontaminated is delicate, such as a PID or a CGI, care must be taken when decontaminating so the equipment is not damaged. The best way to avoid the need to decontaminate items such as these is to prevent contact with contamination in the first place. Develop a method of wrapping/bagging these instruments in polyethylene sheeting/bags so that contact with contamination is minimized but the performance of the instrument is not adversely effected(i.e. the knobs made inaccessible, the meter covered, etc.).

Good field decontamination is essential to a successful sampling event. If the field decontamination is done properly, then secondary (at the warehouse decontamination center) decontamination is only a precautionary measure.

6.3 Secondary Decontamination

Secondary decontamination is a precautionary procedure designed to remove minute levels of contaminants from the sampling/monitoring equipment. However, gloves resistant to the potential contaminants should still be worn as a personal protection measure.

The procedures for secondary decontamination are dependent upon the item being decontaminated. For equipment(shovels, trowels, bailers, buckets, etc.) that come into direct contact

with contaminated soils, liquids, pure-product, or sludges, the following procedure is recommended:

(1) immerse the item in a warm tap water and detergent solution;
(2) use a soft, bristle brush to scrub the inside and outside of the item thoroughly(if the item is a bailer, use a bottle brush to scrub the inside of the bailer);
(3) rinse the item with warm tap water;
(4) wipe or spray with methanol (if determined to be necessary, the need for methanol decontamination will be addressed on an individual site basis and discussed in the site specific sampling plan;
(5) rinse the item with deionized or tap water, and;
(6) let the items air dry in an area free from possible sources of contamination.

Secondary decontamination of instruments(PID, CGI, pH meter, conductivity meter, etc.) is sometimes difficult but nonetheless necessary. The objective is to decontaminate the outside of the instruments to prevent the spread of contamination. First, moisten a sponge/cloth with warm, soapy water and scrub the outside assembly of the instrument, being careful not to get water in any fixtures such as controls or attachment ports. Next the instrument should be wiped with a clean, deionized water soaked sponge/cloth. Wipe the outside of the instrument with a dry paper towel to remove any moisture.

6.4 Large Equipment Decontamination

For site work involving large equipment, such as backhoes, bulldozers, drill rigs, etc., a site specific decontamination procedure will be required in the Site specific work plan. As a guideline, a thorough brushing, scraping, washing and/or steam cleaning should be completed. Such maximum contact points as tires, treads, buckets, blades, and drill pipe/bits, should be thoroughly decontaminated in an effort to prevent migration of contaminants off the site. At sites where equipment becomes highly contaminated, provisions to collect rinsate water/solutions may have to be made.

6.5 Alternatives

Decontamination is, by its nature, an arduous and painstaking task which is often better to avoid. This Division will exercise the option to avoid decontamination procedures whenever feasible by implementing alternative plans of action. Such alternatives are:

(1) dedicating specific equipment to a specific site(i.e. specific bailers to specific wells) when economically feasible;
(2) using disposable equipment when applicable(drum thieves), and;
(3) wrapping monitoring equipment in plastic bags(or other materials) to protect from contamination. It is important to keep monitoring equipment such as photoionization detectors(PID) or combustible gas indicator(CGI) from contacting soil or liquids at hazardous substance sites. If an instrument(PID or CGI) becomes contaminated it must be decontaminated. By eliminating contact with contamination and/or using disposable equipment, decontamination of equipment may be avoided.

7.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

To insure that decontamination procedures are meeting the expectations/requirements (i.e., removing detectable levels of contamination) equipment blanks must be taken and analyzed as stated in the site specific SAP. For items of equipment that are used for sampling (bailers, trowels, etc.), run blank water (supplied by the lab) through/over the item into an appropriate container for analysis of the contaminant of concern (the last type of contamination the item was used to sample). Items such as pH meters, conductivity meters, PIDs and CGIs must be calibrated after use to insure proper future measurements/readings.

7.1 Trouble Shooting

If a decontamination blank is analyzed and found to contain a contaminant, possible sources of error will have to be investigated to determine whether or not the decontamination procedures were properly followed. Decontamination blanks are taken and analyzed at the discretion of the field personnel involved and/or the project manager. Possible sources of error include: inadequate scrubbing/ washing/ rinsing of equipment; use of contaminated detergents or rinse waters; contact with contaminants after decontamination but prior to sampling, and/or, lab error. As always, personnel should not be wearing cologne, bug repellant, or pumping gasoline on days that they are handling sampling equipment.

With close attention being paid to detail, problems should not arise very often.

8.0- REFERENCES

US DHHS, 1985. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. U.S. Department of Health and Human Services, Washington, D.C..

US EPA, 1984. Standard Operating Safety Guides. Office of Emergency and Remedial Response, Washington, D.C..

Department of Environmental Protection
Bureau of Remediation & Waste Management
RCRA Program

Standard Operating Procedure Change Record

Title: **ASSEMBLY, INSTALLATION AND RETRIEVAL OF VAPOR DIFFUSION SAMPLERS**

Identification #: DR018

SOP Originator: Brian Beneski

Author	Revision	Description of Change	Date
Deb Stahler	RCRA 01	Substitute MEDEP/RCRA in the place of MEDEP/DR, and Division of Oil and Hazardous Materials in the place of Division of Remediation. Section 2.0 Introduction: Change first sentence to "MEDEP/RCRA is responsible for the investigation and subsequent corrective actions for RCRA facilities throughout Maine."	5/31/02

Approved by:

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Scott Whittier, RCRA Program Director Date:

ASSEMBLY, INSTALLATION AND RETRIEVAL OF VAPOR DIFFUSION SAMPLERS

Maine Department of Environmental Protection
Division of Remediation

Standard Operating Procedure: **DR#018**
REVISION: **#1**
DATE: **August 14, 2000**
Written/Revised by: **Jean Firth**
Reviewed by: **Brian Beneski**

1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Remediation's (MEDEP/DR) procedure for assembly, installation and retrieval of vapor diffusion samplers.

2.0 SCOPE

This procedure applies to all staff in the MEDEP/DR who are involved with the assembly, installation and retrieval of vapor diffusion samplers. This procedure describes the materials that are acceptable for assembling the samplers, the methodology for installing the samplers and the methodology for retrieving the samplers.

3.0 INTRODUCTION

The MEDEP/DR uses standard operating procedures (SOP) as guidance in performing many tasks. This SOP establishes the proper methods for implementation of the vapor diffusion sampler assembly, installation and retrieval procedure and should insure consistency among MEDEP/DR staff. Proper assembly, installation and retrieval of these samplers is essential for obtaining valid data that is legally defensible. Vapor diffusion samplers are devices that are put in place and left for a period of time while volatile vapors passively collect in the sampler from the media that they are installed in.

4.0 RESPONSIBILITIES

All MEDEP staff must follow this procedure when assembling, installing and or retrieving vapor diffusion samplers. All manages and supervisors are responsible for ensuring (via training, required reading, etc.) that their staff understand this procedure and strictly adhere to it for all assembly, installation and retrieval of vapor diffusion samplers.

5.0 EQUIPMENT

Vapor Diffusion Samplers are comprised of a 40ml VOA vial (not acidified), two plastic sandwich bags (such as zip lock) and closure devices (such as elastics and cable ties).

6.0 PREPARATION

Prior to conducting any sampling event, a sampling and analysis plan (SAP) must be developed according to the procedures outlined in MEDEP/DR SOP DR#014 – Development of a sampling

and Analysis Plan. The sampling plan should describe the location of the samplers or the interval of placement (e.g. every 25 feet). The methodology for analysis should be stated in the sampling SAP.

7.0 ASSEMBLY OF VAPOR DIFFSION SAMPLERS

a. Remove the cap from the VOA vial. ***Save these you will need them later.***

b. Open a plastic sandwich place the VOA vial inside and pull the bag tight over the opening of the bottle.

c. Secure the bag with an elastic or cable tie so that the bag remains taught over the opening of the bottle. This allows air to pass through the sandwich bag and keeps water out.

d. Open another sandwich bag and place the wrapped VOA vial inside and secure with a cable tie. This layer provides abrasion protection of the sampler during installation.

8.0 INSTALLATION OF VAPOR DIFFISION SAMPLERS

a. Secure a flag to the assembled diffusion sampler using another cable tie (Optional).

b. Bury the diffusion sampler 6 to 8 inches at your chosen location.

c. If you have not attached the flag directly to the sampler place a flag near your sample container or other wise mark the location.

d. If a global positioning system (GPS) unit is available, GPS the locations (Optional).

e. Install samplers as described in the SAP.

9.0 RETRIEVAL OF VAPOR DIFFUSION SAMPLERS

a. Find the flagging that marks the location of the sampler or use a GPS unit to locate the sampler.

b. Gently retrieve the sampler from the sample media.

c. Remove the outer bag.

d. Replace the cap on the VOA vial directly over the inner bag.

e. Place in a cooler at 4°C.

f. Submit to a laboratory for analysis by the method stated in the SAP.

10.0 DECONTAMINATION

If the sampler was installed in an obviously contaminated media, the shovel which was used to install the sampler or retrieve the sampler must be decontaminated between sample locations as outlined in MEDEP/DR SOP DR#017 – Decontamination Procedures.

11.0 DOCUMENTAION

Field notes should be recorded as described in MEDEP/DR SOP DR#013 – Documentation of Field Notes and Development of a Sampling Event Trip Report.

SAMPLING CRITERIA FOR ORGAINIC AND INORGANIC PARAMETERS

Organics

Test	Method[1]	Sample Size	Type Container	Preservative	Hold Time	Notes
GRO (water)	ME 4.2.17	2-40 ml	G, TLS[3]	cool, 4 C, HCl pH<2	14 Days	trip blank may be needed
GRO (soil)	ME 4.2.17	2-40 ml or 60 ml	G, TLS[3]	Methanol & cool, 4 C -**or**- freeze samples without methanol	14 Days	see GRO in Soil SOP
DRO (water)	ME 4.1.25	1L	Amber G,TLS[3]	cool, 4 C; HCl or sodium bisulfate	7 Days extraction	minimize plumbing grease contamination
DRO (soil)	ME 4.1.25	200g	G,TLS[3]	cool, 4 C	14 Days extraction	
SVOC (water)	3510C or 3520C/ 8270C	1L	Amber G,TLS[3]	cool, 4 C	7 Days extraction	minimize phthalate contamination
SVOC (soil)	3540C or 3541/ 8270C	200g	Amber G,TLS[3]	cool, 4 C	14 Days extraction	
PCB in water	3510C or 3520C/ 8082	1L	Amber G,TLS[3]	cool, 4 C	7 Days extraction	
PCB in soil	8082	200g	Amber G,TLS[3]	cool, 4 C	14 Days extraction	3550B extraction may be used with caution
Pesticides in water	3510C or 3520C/ 8081A	1L	Amber G,TLS[3]	cool, 4 C	7 Days extraction	
Pesticides in soil	3540C or 3541/ 8081A	200g	Amber G,TLS[3]	cool, 4 C	14 Days extraction	3550B extraction may be used with caution
Herbicides in water	8151A	1L	Amber G, TLS[3]	cool, 4 C	7 Days extraction	
Herbicides in soil	8151A	200g	Amber G, TLS[3]	cool, 4 C	14 Days extraction	
Volatiles (water)	5030/ 8260B 524.2 [DW]	2-40 ml vials	G, TLS[3]	cool 4 C, HCl pH<2	7 Days 14 Days	trip blank may be needed
Volatiles (soil)	5035/ 8260B	3 samples	encore sampler	cool, 4 C	48 hours	extra sample for % solids
or	5035/ 8260B	3-40 ml vials, 5g in each vial	G, TLS[3]	cool, 4 C; sodium bisulfate soln. in 2 vials and methanol in 1 vial	14 days	acetone may be generated as an artifact extra sample for % solids
or	8260B	3-40 ml vials	G, TLS[3]	freeze	14 days	EPA Region 1 guidance 5g in each vial extra sample for % solids

SAMPLING CRITERIA FOR ORGAINIC AND INORGANIC PARAMETERS

Metals

Test	Method[1]	Sample Size	Type Container	Preservative	Holding Time	Notes
Dissolved metals	6010B, 6020 or 7000 series	1 L	cube cont.	HNO3 to pH<2	6 Mos.	Filter on site
Total metals in water	6010B, 6020 or 7000 series 200.7, 200.8, & 200.9 for drinking water	1 L	cube cont.	HNO3 to pH<2	6 Mos.	For RCRA 8 1L includes mercury
Total metals in soil	6010B, 6020 or 7000 series	200g	Whirlpack	none	6 Mos.	
Dissolved Mercury	7470A 245.1 [DW]	1 L	cube cont.	HNO3 to pH<2	28 Days	Filter on site
Total Mercury in water	7470A	1 L	cube cont.	Cool 4 C ; HNO3 to pH<2	28 Days	
Total Mercury in soil	7471A	200g	Whirlpack	Cool 4 C	28 days	

TCLP

Test	SW 846 Method	Sample Size	Type Container	Preservative	Hold Time
TCLP-VOC	1311/ 8260B	4 oz	G, TLS[3]	cool, 4 C	NA
TCLP-Metals	1311/ 6010B or 7000 series	4 oz	G	none	NA
TCLP – herbicides	1311/8151	1 L	G, TLS[3]	cool, 4 C	NA

MISC.

Test	Method[1]	Sample Size	Container	Preservative	Hold Time	Notes
Reactive Sulfide & Reactive Cyanide	SW846 Chapter 8 section 3	2- 4 oz jars	G	none	NA	
Flash point	1010, 1020A	4 oz	G, TLS[3]	cool, 4 C	NA	
pH[2]	9040A, 9041A, 9045B for soil	4 oz	G	none	NA	
Maine Waste Oil Parameters [4]		2 4 oz amber	G, TLS[3]	none	NA	
Bacteria (water)	As approved by EPA for Drinking or Waste Water	200 ml	Sterilized	Cool 4 C	30 hours	Use gloves!

Notes:
1. Sw 846 methods, except as noted
2. For situations where the material is very light (e.g. fly ash, feathers, etc.) please provide more material than a 4-oz jar.
3. TLS = Teflon lined cap
4. Maine Waste Oil Parameters include PCBs, flash point, total Halogens, arsenic, cadmium, chromium, and lead